SPECIAL REPORT

LAND RESOURCES

TEXAS COASTAL BASINS

TYPE IV COOPERATIVE RIVER BASIN SURVEY

BY

THE UNITED STATES DEPARTMENT OF AGRICULTURE
IN COOPERATION WITH
THE TEXAS WATER DEVELOPMENT BOARD
THE TEXAS STATE SOIL AND WATER CONSERVATION BOARD
INTERAGENCY COUNCIL ON NATURAL RESOURCES AND THE ENVIRONMENT
THE TEXAS WATER RIGHTS COMMISSION

SEPTEMBER 1977

COOPERATIVE RIVER BASIN SURVEY

TEXAS COASTAL BASINS

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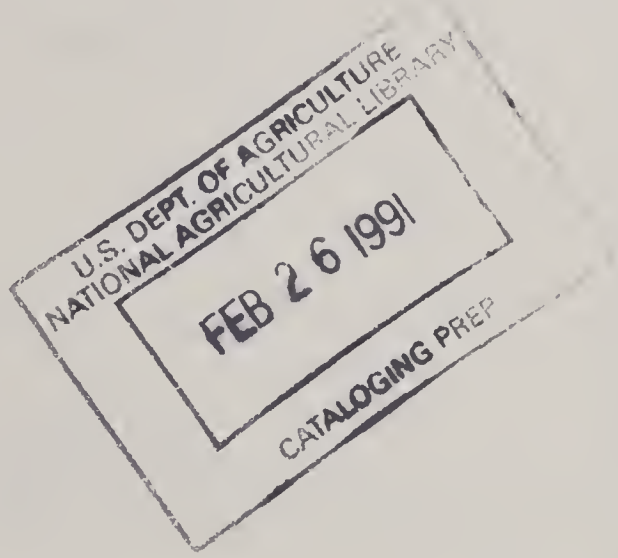

SEPTEMBER 1977

SPECIAL REPORT

LAND RESOURCES

IN THE

TEXAS COASTAL BASINS

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LAND RESOURCES
IN THE
TEXAS COASTAL BASINS

INTRODUCTION

The term "land" suggests different things to different people, depending upon their outlook and their interest at the moment. In its most widely accepted use, this term refers to the solid portion of the earth's surface. More specifically, land is an integral member of a complex biological system that includes soils, plants, water, and animals, all of which make up the continuing life cycle. Within the context of this report land is defined as the total natural resources of the earth's surface.

Purpose

The general purpose of this report is to provide information about man's use of land resources in the study area. Problems and needs associated with varied uses are documented. The data contained herein shall contribute to formulation of plans to satisfy the national economic development objective and the environmental quality objective.

In order to fulfill the general purpose stipulated above, the specific purposes of this report are to:

(1) Present current land use data - distribution and amount

(2) Group land use into land capability classes and subclasses

(3) Describe and enumerate present and needed essential conservation practices

(4) Describe problems and needs associated with land resources

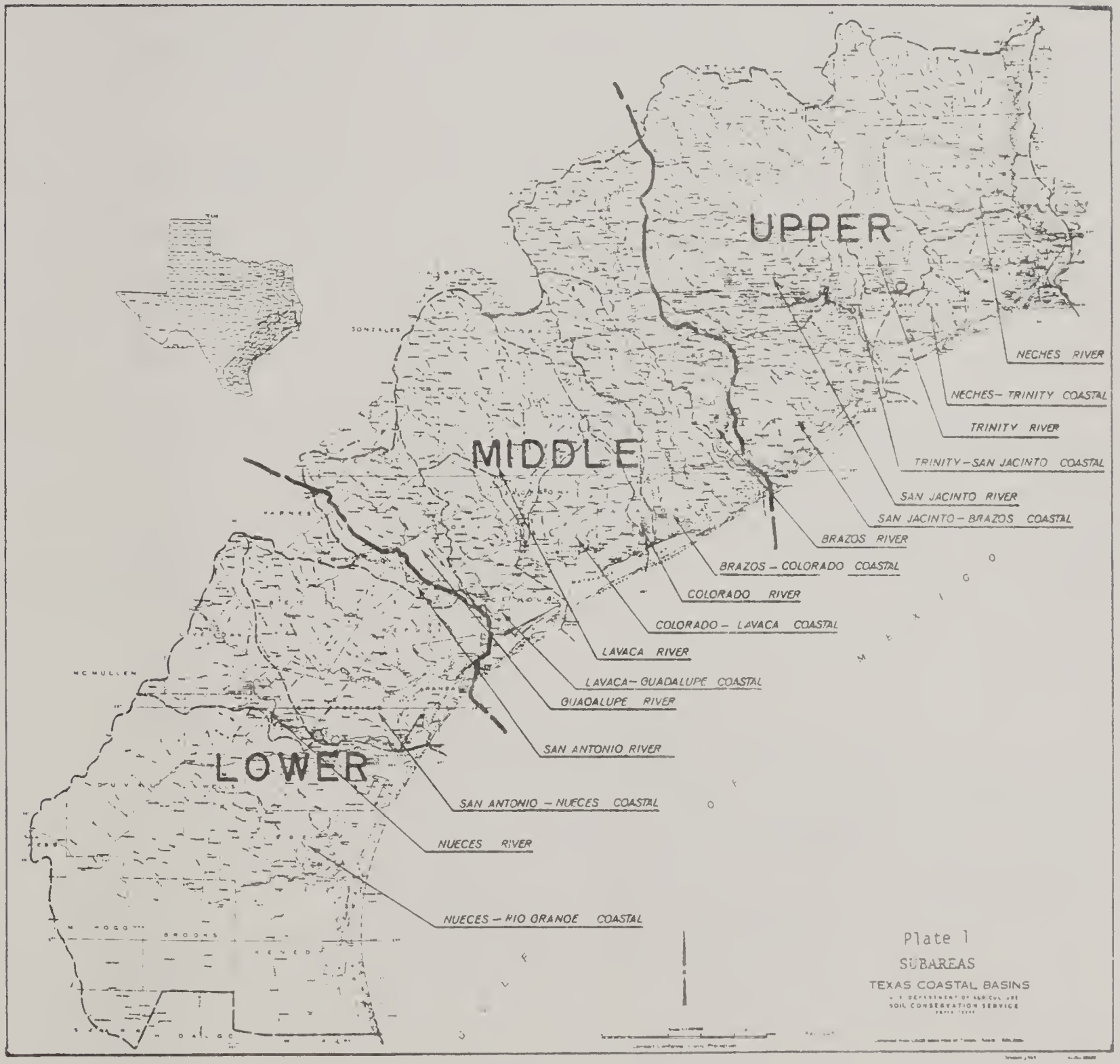
(5) Assess agricultural land potential based on soil suitability

Scope

The land area within the boundaries of the Texas Coastal Basins exceeds 20 million acres. While some water and land problems and needs in this vast area relate to the entire region, many are too complex to attempt a solution on a regional basis. To facilitate plan formulation, the study area was divided into three hydrologic units which are referred to as the Upper, Middle, and Lower Subareas and are shown in Plate 1.

Methodology

Schemes for "clear-cut" classification of land uses are often complicated by the presence of overlapping and multiple use patterns. The absolute delineation of land uses is also complicated by their complementary nature. Forest land is utilized for livestock grazing


UPPER
MIDDLE
LOWER
NECHES RIVER
NECHES– TRINITY COASTAL
TRINITY RIVER
TRINITY–SAN JACINTO COASTAL
SAN JACINTO RIVER
SAN JACINTO–BRAZOS COASTAL
BRAZOS RIVER
BRAZOS – COLORADO COASTAL
COLORADO RIVER
COLORADO – LAVACA COASTAL
LAVACA RIVER
LAVACA– GUADALUPE COASTAL
GUADALUPE RIVER
SAN ANTONIO RIVER
SAN ANTONIO – NUECES COASTAL
NUECES RIVER
NUECES – RIO GRANDE COASTAL
Plate 1
SUBAREAS
TEXAS COASTAL BASINS
SOIL CONSERVATION SERVICE

and farmers in specialized crop production may have a less significant area where livestock are grazed.

A 1971 General Land Use map is shown on Plate 2. The Soil Conservation Service prepared this spatial arrangement as an aid in regional planning.

The designated land use in a delineation constitutes at least 50 percent of the use within that area. This use is the primary goal of the manager or owner and usually contributes a large share of the income. Although correlation with the statistical analyses is very good it is not intended for acreage measurements to be made from this plate. Wooded native pastureland, wooded rangeland, and marsh rangeland are refinements peculiar to Plate 2 and will not be separated in the statistical analyses. In preparing the General Land Use map rice was considered to be the only crop irrigated systematically on a regular basis.

Statistical Data

The Conservation Needs Inventory developed by the U. S. Department of Agriculture in 1957 and updated in 1967 is the source for land use classification and land capability classification. Conservation

treatment needs are also presented for each use in accordance with the capability of the land.

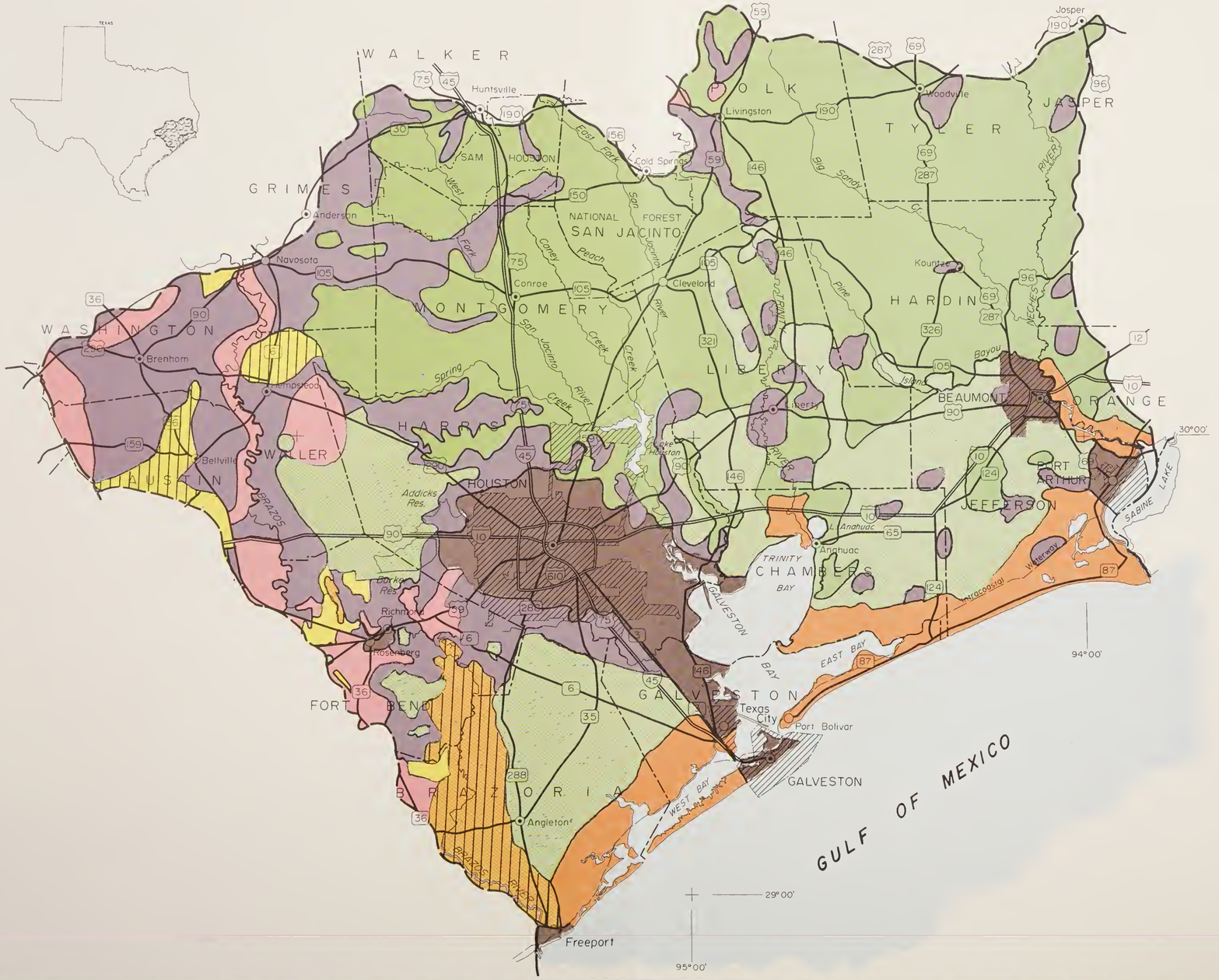
All land use data except that shown on Plate 2 was developed from the Conservation Needs Inventory of 1967.

Relationship of this Special Report to Overall Report

The plan for the development of the resources of the Texas Coastal Basins to meet existing and projected human needs requires the blending of information related to all of the natural resources of the basin. The data presented in this report were developed as a guide for the preservation, development, and improvement of soil, plant, and water resources in consonance with the stated objectives of the comprehensive study. In this regard, the data are related to the factors and influences which are presented in detail in all of the other special reports.

LAND RESOURCE AREAS

The study area includes portions of six land resource areas (LRA) which are shown on Plate 3. A land resource area is a geographical area characterized by similarities of soil, topography, climate, and vegetation. A brief description of each land resource area is shown in Table 1. Each area is further discussed in the following paragraphs.



LEGEND

- Cropland, Dry
- Cropland, Irrigated
- Forest
- Native Pastureland, Wooded
- Pastureland
- Rangeland
- Rangeland, Wooded
- Marsh-Rangeland
- Urban-Industrial

Plate 2

GENERAL LAND USE

TEXAS COASTAL BASINS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

0 10 20 30 40 MILES

APPROXIMATE SCALE
1:1,000,000 or 1 inch = 15.78 miles

Compiled from USGS base Map of Texas
Lambert Conformal Conic Projection

Sheet 1 of 3 4-R-30,558

USDA-SCS-FORT WORTH, TEX. 1971

May 1971 4-R-28553C

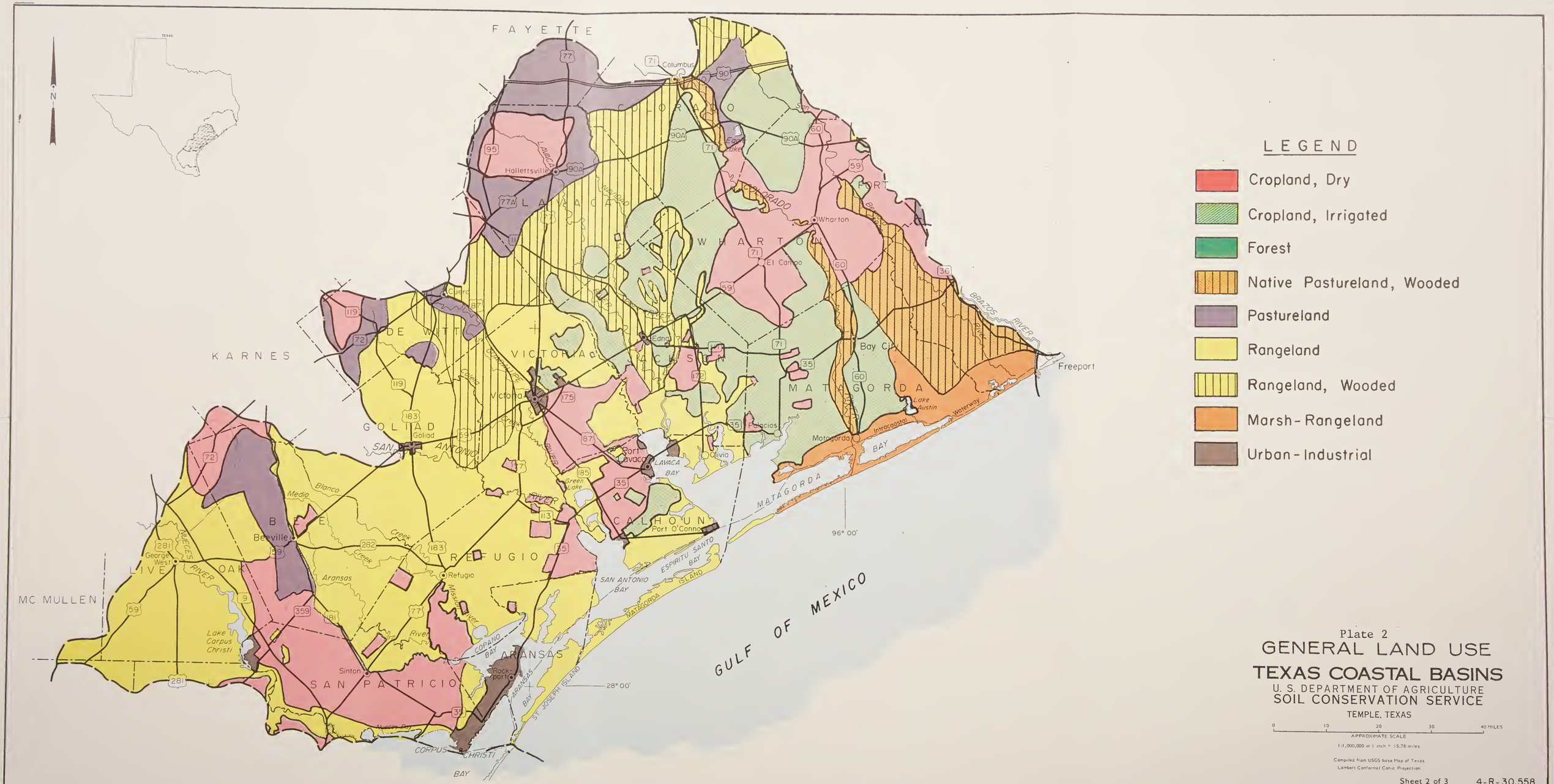


Plate 2

GENERAL LAND USE

TEXAS COASTAL BASINS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

0 10 20 30 40 MILES

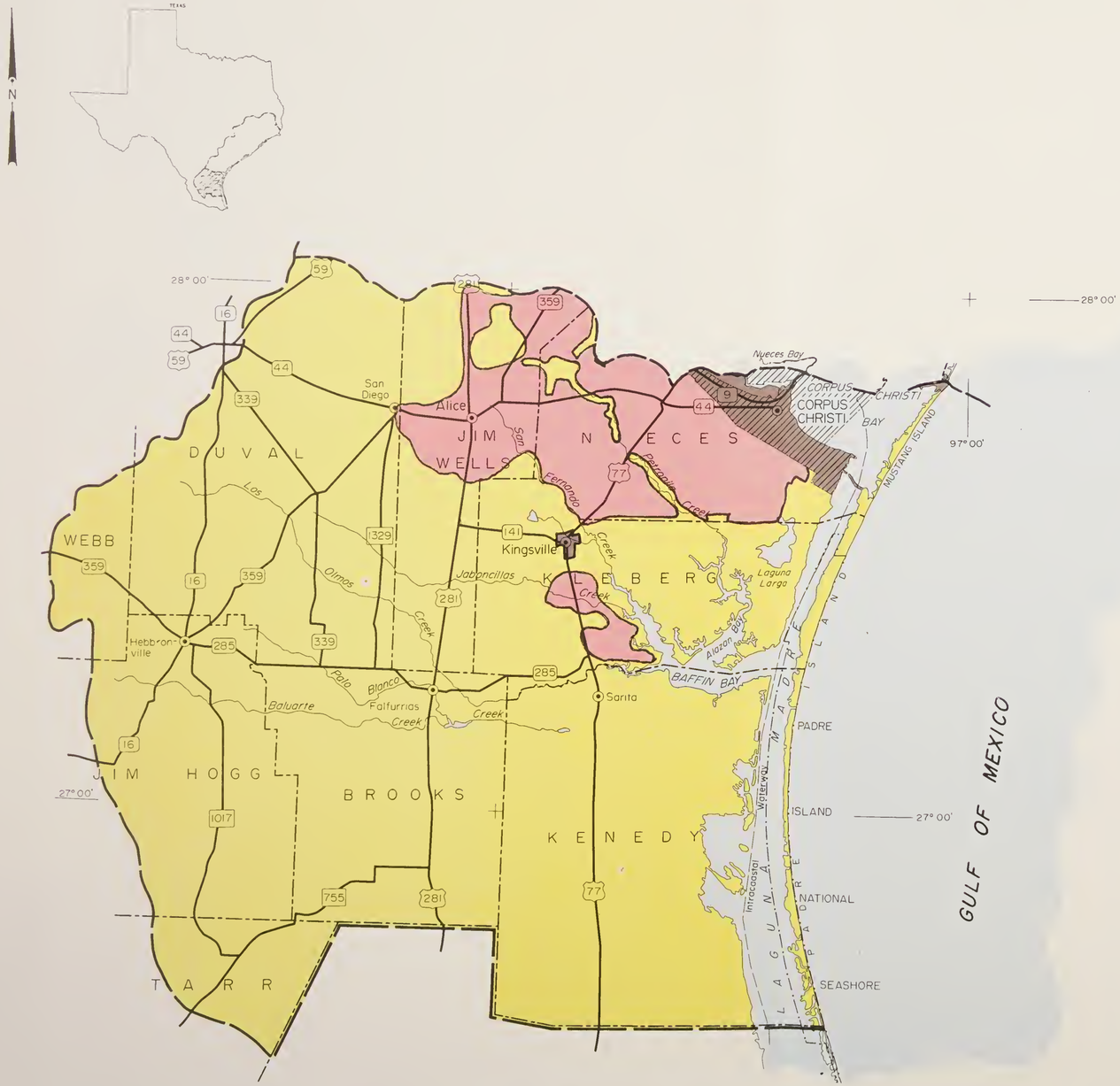
APPROXIMATE SCALE
1:1,000,000 or 1 inch = 15.78 miles

Compiled from USGS base Map of Texas
Lambert Conformal Conic Projection

Sheet 2 of 3 4-R-30,558

USDA-SCS FORT WORTH, TEX. 1971

May 1971 4-R-28553C



LEGEND

- Cropland, Dry
- Cropland, Irrigated
- Forest
- Native Pastureland, Wooded
- Pastureland
- Rangeland
- Rangeland, Wooded
- Marsh-Rangeland
- Urban-Industrial

Plate 2

GENERAL LAND USE

TEXAS COASTAL BASINS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

0 10 20 30 40 MILES

APPROXIMATE SCALE
1:1,000,000 or 1 inch = 15.78 miles

Compiled from USGS base Map of Texas
Lambert Conformal Conic Projection

Sheet 3 of 3 4-R-30,558

USDA-SCS-FORT WORTH, TEX 1971

May 1971 4-R-28553C

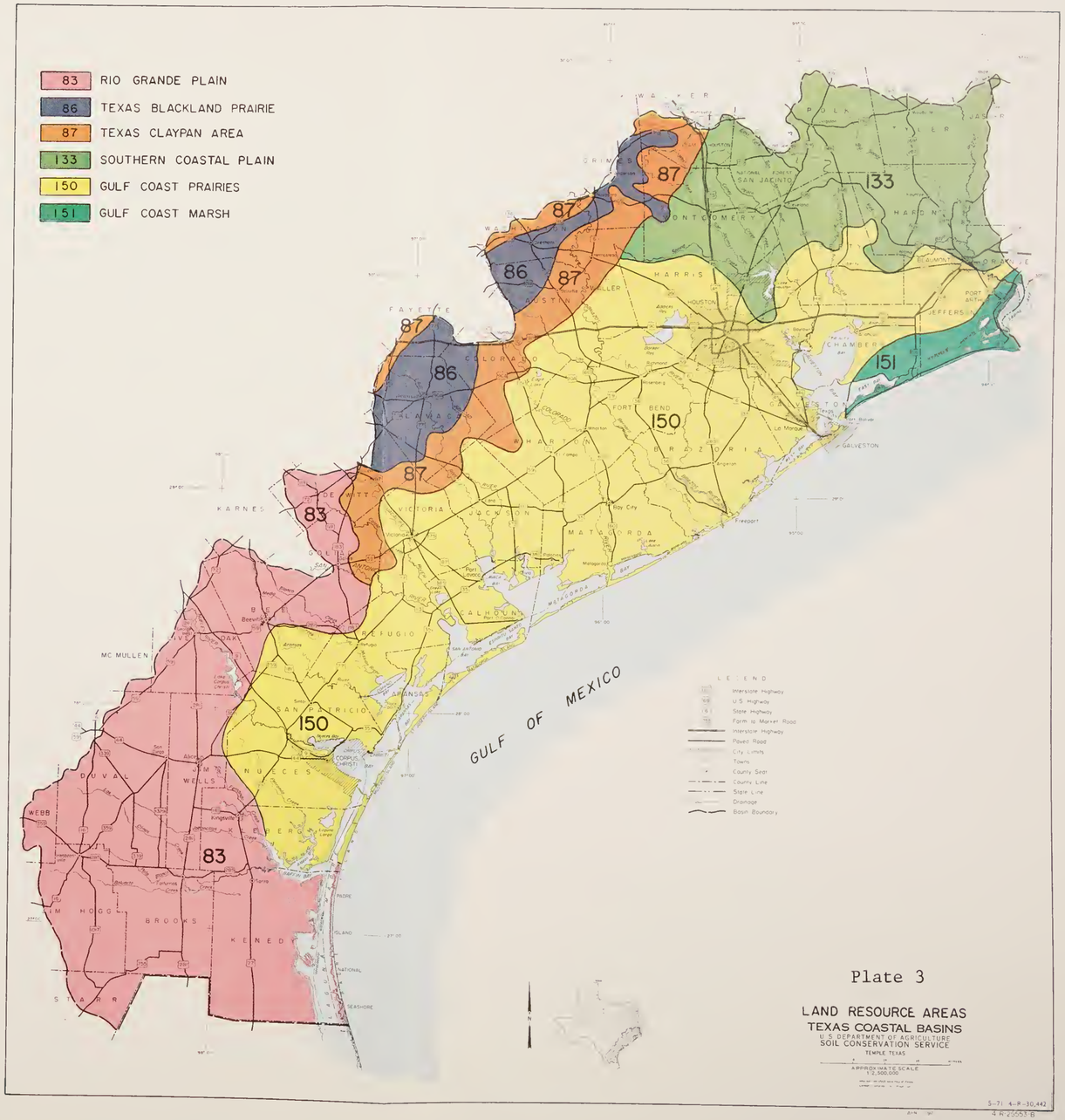

83 RIO GRANDE PLAIN
86 TEXAS BLACKLAND PRAIRIE
87 TEXAS CLAYPAN AREA
133 SOUTHERN COASTAL PLAIN
150 GULF COAST PRAIRIES
151 GULF COAST MARSH
GULF OF MEXICO
LEGEND
Interstate Highway
U.S. Highway
State Highway
Farm to Market Road
Interstate Highway
Paved Road
City Limits
Towns
County Seat
County Line
State Line
Drainage
Basin Boundary
Plate 3
LAND RESOURCE AREAS
TEXAS COASTAL BASINS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS
APPROXIMATE SCALE
1:2,500,000
S-71 4-R-30,442
4-R-20553-B

TABLE 1

General Characteristics of Land Resource Areas

Texas Coastal Basins

Land Resource Area	Elevation and Topography	Predominant Soil Series	Water	Land Use and Major Crops
150 Gulf Coast Prairies (39% of Texas Coastal Basins)	Sea level to about 200 feet along the interior margin. Only slightly dissected and drainage is deficient in many parts.	Lake Charles, Bernard, Beaumont, Victoria, Edna, Katy, Hockley, Miller, and Norwood.	Moderate to high rainfall and many perennial streams in eastern half. Good supply of ground water and surface water throughout. Excess water a problem.	About half of area in cultivation. Rice, grain sorghum and cotton provide most of crop income. Urban and industrial development very significant.
151 Gulf Coast Marsh (2% of Texas Coastal Basins)	Sea level to less than 5 feet above sea level. Marshes and swamps are broken by shallow lakes and bayous and are crossed by many stream channels. Except for narrow bands of gentle slopes on natural levees, the area is flat.	Harris, Ijam	Much of the area is periodically covered either by tide flow or by stream overflow. Flooding and salinity preclude use of most of area for agriculture.	The marsh is utilized for livestock grazing. Very little is cultivated. Unique wildlife area. Reeds, cattails, cord grasses, bulrush, and salt grasses dominant vegetation.
133 Southern Coastal Plain (20 of Texas Coastal Basins)	100 feet to 400 feet. Gently to strongly sloping.	Conroe, Fuquay, Segno, Spendora, Waller, Sorter, Katy, Wockley	Moderate to high rainfall, many perennial streams. Good supply ground water - localized quality problems.	Forested, small amount of pasture, most land in private ownership. One large national forest. Land use fairly stable.
86 Texas Blackland Prairies (5% of Texas Coastal Basins)	200 to 400 feet nearly level to rolling, well dissected by watercourses.	Ferris, Heiden, Crockett, Engle, Klump, Houston Black.	Good potential for surface water impoundment. Adequate ground water at economical depth.	Mostly improved pastureland. Trend continuing cropland to pastureland. Land ownership is generally small private operating units.
87 Texas Claypan Area (8% of Texas Coastal Basins)	200 to 500 feet nearly level to rolling.	Stratton, Tabor, Trep, Susquehanna , Demona, Patilo	Good sites for surface water impoundment. Many perennial streams. Good supply of ground water.	Covered with postoak and blackjack oak. Principal source of income, livestock. Good deer habitat, trend from woodland to improved pasture.
83 Rio Grande Plain (27% of Texas Coastal (Basins)	Sea level to 900 feet, undualting to gently rolling.	Sarita, Falfurrias, Delfina, Orelia, Leming, Miguel, Delmita, Randata, Olmos, Goliad.	Water Deficient area. Adequate ground water for limited development.	Most of area is managed for production of livestock from native plants.

Source: United States Department of Agriculture, Soil Conservation Service

The gently rolling to nearly level Rio Grande Plain (83) extends into the study area from the south and west and covers about 27 percent of the area. The climax vegetation of this semiarid area was primarily tall bunchgrasses. Presently the vegetation is dominated by various thorny shrubs commonly included in the general term "chaparral". Mesquite trees are common over much of the area. Most soils are underlain by a caliche layer characteristic of soils developed under low rainfall. Moderately deep sandy soils range from slightly acid to neutral. The dominant land use is rangeland, Table 2.

The rolling topography occupied by the Texas Blackland Prairie (86) occupies nearly five percent of the study area and lies in the subhumid climatic zone. Soils range from a brown medium acid to a moderately alkaline sticky clay. The native vegetation is made up of tall bunchgrasses and in some areas the post oak and blackjack oak have encroached from the adjoining oak belt. Oak, elm, cottonwood, and some native pecan trees are found along the flood plains of major streams. The Blackland Prairie has gone from native pastureland to cropland, and because of extensive soil erosion, back to pastureland. Presently two-thirds of this area is covered with introduced grasses and grazed intensively by livestock.

The Texas Claypan (87), commonly called the "Post Oak Belt", covers about eight percent of the Texas Coastal Basins, and is primarily

rolling upland areas containing scattered stands of post oak and blackjack oak intermixed with yaupon and other underbrush. Bunchgrasses grow on more open sites. Bottom lands support large vigorous growing trees, and a wide variety of cool season grasses. Pecan trees are prevalent in some localities. Upland soil profiles usually have a thin, slightly acid layer of sandy loam over a dense clayey subsoil. These soils are droughty and the clayey subsoil impairs plant root development. The soils along major watercourses are acid to calcareous and range from loamy to clayey in texture. This land resource area lies mainly in the subhumid climatic zone. All agricultural uses are represented in this LRA but grazing land use is most common.

The Southern Coastal Plain (133) occupies nearly 20 percent of the study area and is within the humid climatic zone. It is a gently rolling area covered with mixed pine and hardwood forest. The flood plains along streams contain a higher density hardwood species than pine. Alluvial soils support a variety of fruit and nut bearing plants that provide wildlife food. Introduced grasses such as bermudagrass and bahiagrass have been established in cleared areas. The soils are mostly acid, light colored to dark gray sandy, or sandy loams. Most of this area is managed for timber production.

The Gulf Coast Prairies (150) occupies about 39 percent of the study area extending from the Neches River to Baffin Bay. The climate ranges

TABLE 2

Land Use by Land Resource Areas

Texas Coastal Basins

LAND RESOURCE AREA	CROP-LAND	IRR. CROP LAND	FOREST-LAND	PASTURE-LAND	RANGE-LAND	URBAN LAND	WATER AREA (40 ACRES-)	OTHER LAND	TOTAL	PERCENT
	Acres									
Rio Grande Plain (83)	616869			196843	4494406	20289	7700	154728	5490835	27.0
Texas Blackland Prairie (86)	266511		57686	612276	33553		1233	24778	996037	4.9
Texas Claypan Area (87)	173682	64080	257370	485471	627627		2302	46253	1656785	8.1
Southern Coastal Plain (133)	10780	35081	3574092	223017		83475	4439	89122	4020006	19.8
Gulf Coast Prairies (150)	2263959	947246	393734	1251830	1799881	969246	11180	224738	7861814	38.6
Gulf Coast Marsh (151)		42400		16484	243721	17392	548	11013	331558	1.6
TOTAL	3331801	1089807	4282882	2785921	7199188	1090402	27402	550632	20357035	100.0

Source: United States Department of Agriculture, Soil Conservation Service

from humid to semiarid. The surface is flat for several miles inland from the coast. The soils are primarily calcareous clay loams near the coast becoming slightly acid and more sandy farther inland. The clay loam and clay soils have nearly level surfaces with slow to very slow drainage. The native vegetation consists of coarse grasses with a narrow fringe of trees along the streams. Much of this area is now covered by improved pasture grasses and cultivated crops. About four-fifths of the cultivated land in the Texas Coastal Basins is found in this LRA.

The Gulf Coast Marsh (151) is a narrow strip of wet lowland adjacent to the coast in the humid climatic zone comprising 1.6 percent of the study area. The soils have little development and represent two extremes in soil texture. A gray mottled wet clay soil occupies the low flat areas that merge with the tidal marsh. A deep, loose, nearly white sand is found on low ridges and along the beaches. The water table is near or above the surface during most of the year. This condition supports plant communities of maidencane, cattails, and bulrush in the fresh marsh and cordgrass, saltgrass, and common reed in the saline marsh.

LAND USE

Information in this section was extracted from the Conservation Needs Inventory (CNI) which was initiated in 1957 and updated in

1967. This inventory was concerned with private agriculture land and associated rural areas.

This analysis deals with inventory land which includes the following land uses: cropland - dry and irrigated, pastureland, rangeland, forest land, and other land. This total will not equal the basin's total area because of excluded water areas, federal land, and urban built-up. Figure 1 reveals the percent each land use occurs within the basin.

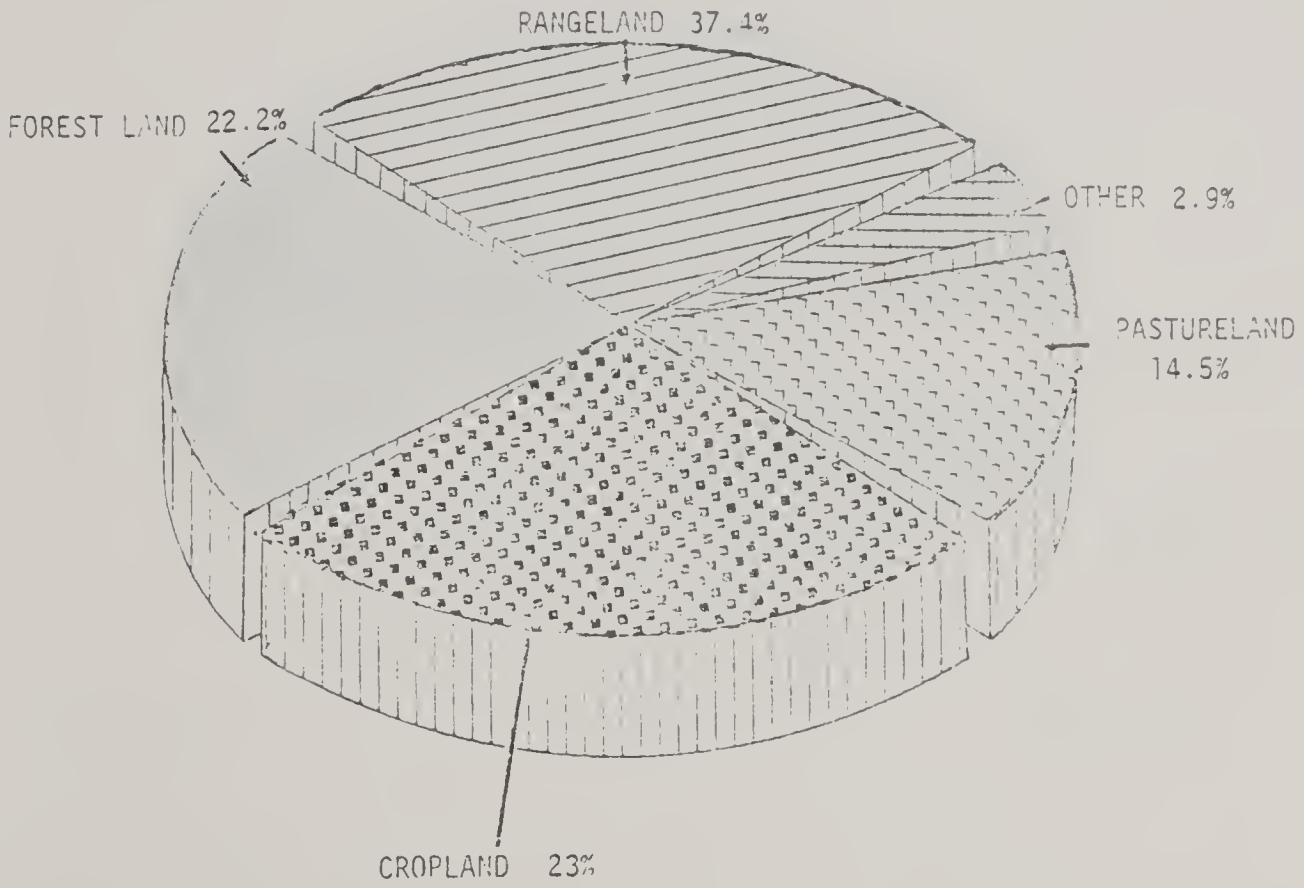
Dry cropland is the acreage in a tillage rotation, orchards, and land formerly used for crops which has not been purposely converted to another use. Lands used for hay meadows are included in cropland. Irrigated cropland is land on which irrigation water has been applied by an adapted irrigation system at least two of the past five years. Figure 2 shows the major crops being grown in the basin. Rice is the principal irrigated crop even though other crops may receive supplemental irrigation water.

Pastureland includes areas on which acclimated forage plants have been introduced for soil and water conservation and increased production for livestock consumption. Generally, this unit is referred to as improved pastureland because of the plants' ability to respond to high levels of fertilization and more intensive management.

FIGURE 1

Agricultural Land Use, 1970

Texas Coastal Basins
(Subarea)

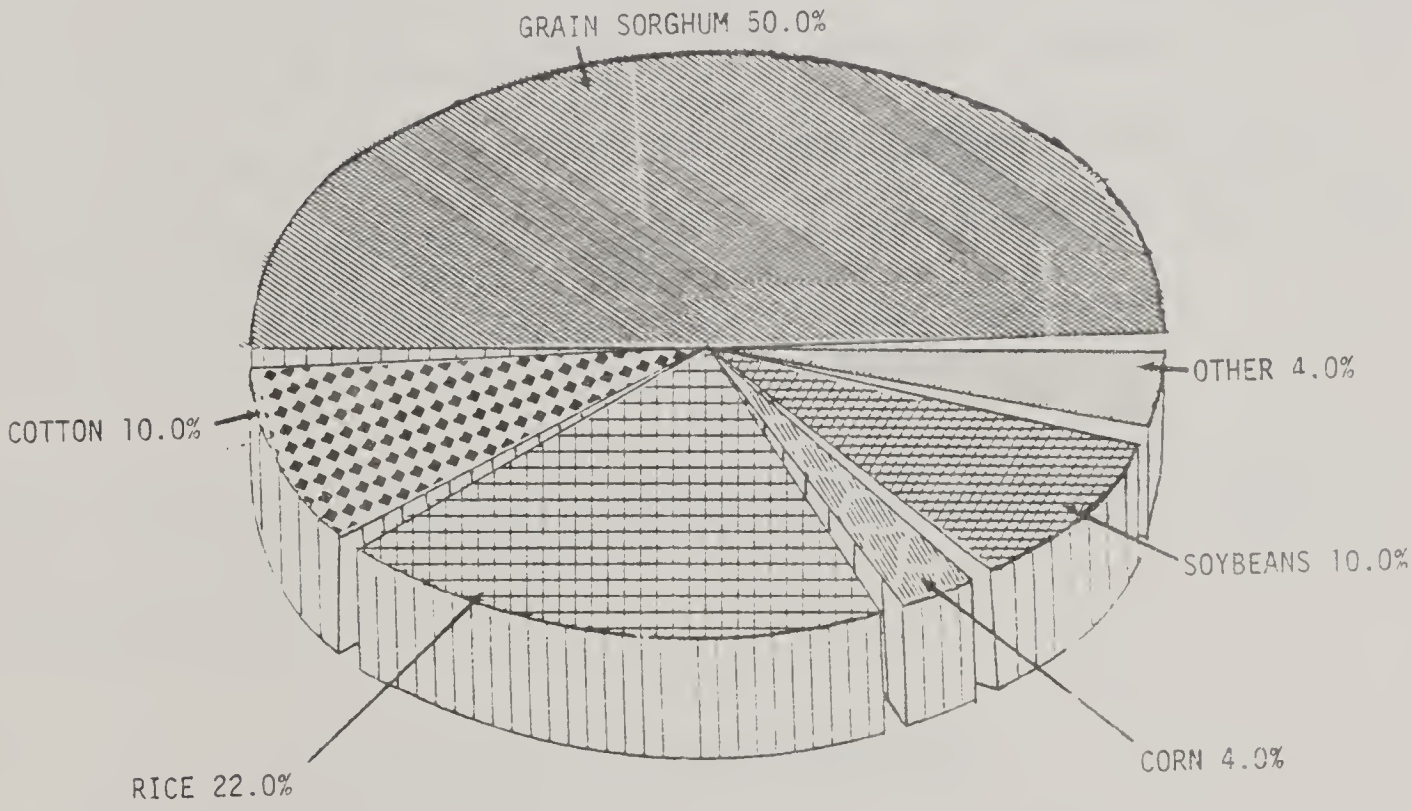


Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

FIGURE 2

Major Crops Planted 1/

Texas Coastal Basins



1/ From 1973 Texas County Statistics

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

Rangeland is land on which the natural plant community is composed principally of native grasses, forbs, and shrubs. Generally, this land is not fertilized, drained, or cultivated. If it is revegetated to improve the forage cover it is managed like native vegetation.

Forest land is (a) land at least 10 percent stocked by forest trees of any size and capable of producing timber or other wood products, or capable of exerting an influence on the water regime; (b) land from which the trees described have been removed to less than 10 percent stocking and which have not been developed for other uses; (c) afforested (planted) areas; and (d) chaparral areas.

Other land is all other non-federal land not classified into one of the uses described above.

Land Capability Classification

Land capability classification is made by careful field investigation. Scientifically trained technicians gather information concerning the depth, texture, permeability, slope, erosion, inherent fertility, and other characteristics of the soil which affect the use, management, and treatment of the land. With these facts and a knowledge of the local climate land can be classified according to its capability - its ability to produce permanently under specified uses and treatments.

This land capability classification is a systematic arrangement of different kinds of land according to those properties that determine the ability of the land to produce permanently. The degree of permanent limitation imposed by natural land characteristics necessarily affects: (a) the number and complexity of conservation practices; (b) the productivity; and (c) the intensity and manner of land use - for example, the choice of crops on cropland or the amount and season of use on grazing land.

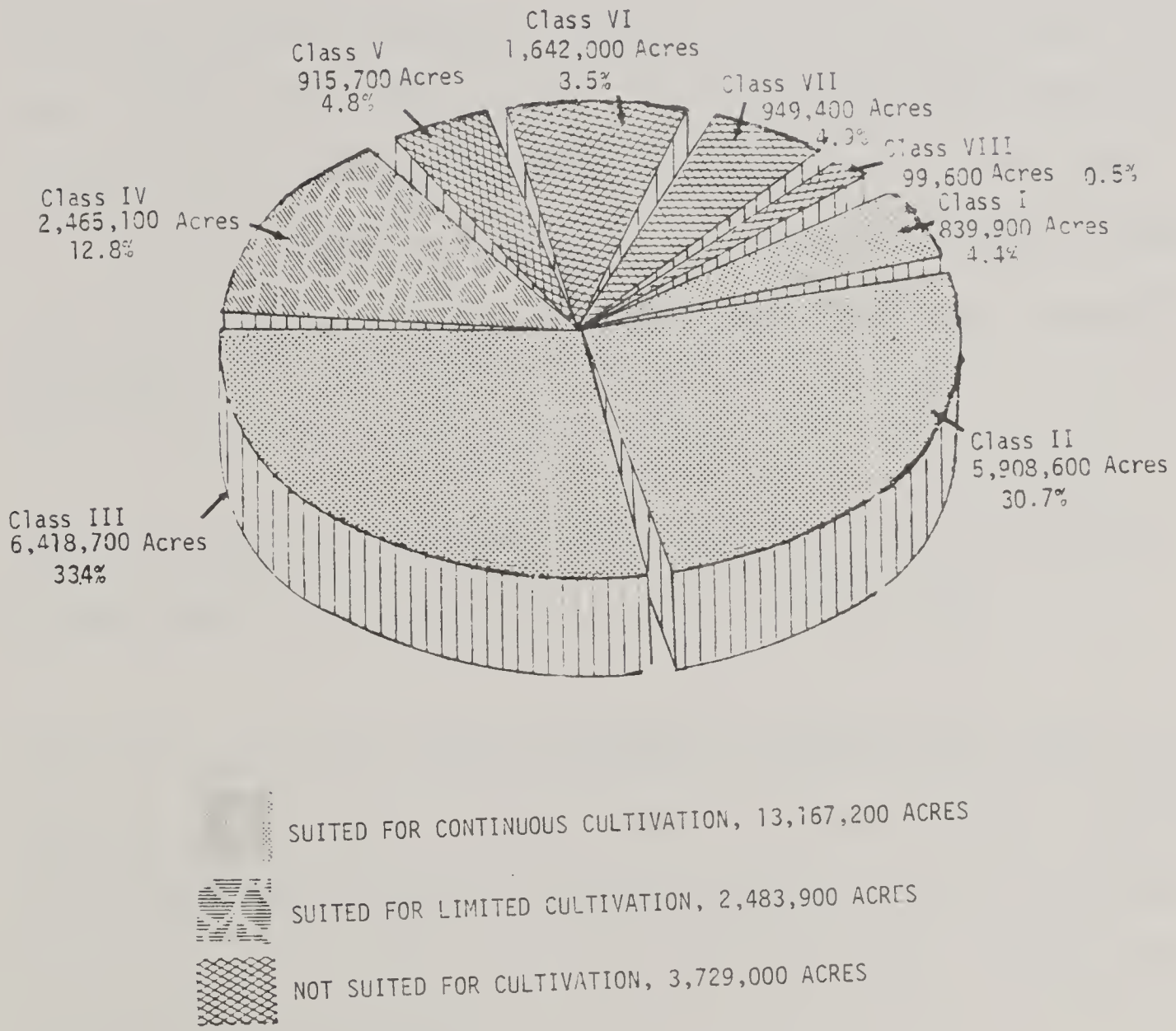
In the capability system, all lands of soils are grouped on three levels: capability class, subclass, and unit. In this report soils are placed in only the first two levels which are defined in the following paragraphs.

To help define the natural variation of soils for various uses the SCS has grouped all soils available for agricultural uses into eight land capability classes which are designated by Roman numerals I through VIII, Figure 3. Generally, the suitability of the soil for agricultural uses decreases from Class I to Class VIII. Soils in the first four classes under good management are generally defined as land suited to cultivation. Classes I to III, with use of proper conservation measures, are recommended for continuous cultivation, and Class IV is recommended for limited cultivation. Soils in Classes V through VIII are generally defined as land limited in use - not generally suited to cultivation, but are best used for

FIGURE 3

Land Capability Classes for Agricultural Land. 1967

Texas Coastal Basins



Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

pasture, forest, wildlife habitat, recreation, water supply, and aesthetic purposes. A general description of each class follows:

Soils in Class I have few limitations that restrict their use. They are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, forest, and wildlife. These soils are nearly level, and erosion hazard is low. They are deep, generally well drained, and easily worked. They hold water well, and are either fairly well supplied with plant nutrients, or are highly responsive to inputs of fertilizer. They are not subject to damaging overflow and will maintain productivity with ordinary management practices.

Soils in Class II have some limitations that reduce the choice of plants and/or require moderate conservation practices.

Soils in this class require management to prevent soil loss or to improve air and water relations under cultivation. The limitations are few and the practices are easy to apply. The soils are best suited to use for cultivated crops, pasture, range, forest, and wildlife food and cover.

Soils in Class III have severe limitations that reduce the choice of plants and/or require special conservation practices. These soils are best suited to use for cultivated crops, pasture, forest, range,

and wildlife food and cover. Their limitations restrict the amount of clean cultivation, timing of planting, tillage, and harvesting; choice of crops; or a combination of these.

When cultivated, many of these wet, slowly permeable, nearly level soils require a drainage system and a cropping system that maintain or improve the structure and tilth of the soil. Each distinctive kind of soil in Class III has one or more alternative combinations of use and practices required for safe use, but the number of practical alternatives for average farmers is less than for soils in Class II.

Soils in Class IV have very severe limitations that restrict the choice of plants and/or require very careful management. These soils are best suited to use for crops, pasture, forest, range, and wildlife food and cover. They may be well suited to only two or three of the common crops, or the production may be low in relation to inputs over a long period.

Many sloping soils are suited for occasional, but not regular, cultivation. Some of the poorly drained, nearly level soils are not subject to erosion, but are not well suited to crops because of the time required for the soil to dry out in the spring.

Soils in Class V have little or no erosion hazard, but have other limitations, impractical to remove, that limit their best use largely to pasture, range, forest, and wildlife food and cover.

Limitations restrict the kinds of plants that can be grown and prevent normal tillage of cultivation crops. These soils are nearly level, wet, or frequently overflowed by streams.

Soils in Class VI have severe and continuing limitations that cannot be corrected, and that make them generally unsuited for cultivation and limit their best use largely to pasture or range, forest, and wildlife food and cover. It is, however, practical to apply range or pasture improvement measures.

Soils in Class VII have very severe limitations that make them unsuited for cultivation, and that restrict their best use largely to grazing, forest, or wildlife forage and cover. The physical condition of these soils make it generally impractical to develop improved pasture.

Soils and landforms in Class VIII have limitations that preclude their use for commercial plant production, and restrict their best use to recreation, wildlife, water supply, or aesthetic purposes.

Land Capability Subclasses

Capability subclasses are soil groups within one class; they are designated by adding a small letter, e, w, s, or c, to the class numeral, for example, IIc. The letter e shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w

shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In Class I there are no subclasses, because the soils of this class have few limitations. Class V contains only the subclasses indicated by w, s, or c, because the soils in Class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, range, woodland, wildlife habitat, or recreation.

There are 6.7 million acres of soils in the Texas Coastal Basins with a primary limitation of erosion (e), Table 3. There are 861,346 acres of cropland on which erosion is the main limitation to use. The acreage in rangeland, pastureland, and forest land does not present a problem unless the vegetative cover is removed or severely reduced.

Wetness (w) is the most realistic problem of natural resources management in the Texas Coastal Basins, Table 4. Wetness not only reduces productive capability but interferes with the timing of cultural operations.

TABLE 3

Inventory Land with an Erosion Hazard 1/
1967

Texas Coastal Basins

Subarea	Total Agricultural "e" Land	Cropland	Pastureland	Rangeland	Forest Land	Other
Upper	1,241,348	63,521	255,629	39,336	870,212	12,650
Middle	1,707,737	394,155	472,488	470,896	329,052	41,146
Lower	3,766,979	403,670	145,692	2,979,472	154,602	83,543
TOTAL	6,716,064	861,346	873,809	3,489,704	1,353,866	137,339

1/ Erosion hazard is indicated in SCS land capability subclass "e" -- shows the main limitation is risk of erosion.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 4

Inventory Land with a Wetness Hazard 1/
1967

Texas Coastal Basins

Subarea	Total Agricultural "w" Land	Cropland	Pastureland	Rangeland	Forest Land	Other
Upper	3,649,075	720,021	642,164	380,169	1,813,382	93,339
Middle	1,290,807	447,784	194,364	357,812	238,700	52,147
Lower	654,579	136,403	28,107	431,579	13,769	44,721
TOTAL	5,594,461	1,304,208	864,635	1,169,560	2,065,851	190,207

1/ Wetness hazard pertains to excess water in or on the soil which limits plant growth and inhibits cultural practices.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

About 5.3 million acres have a low moisture holding capacity in the Texas Coastal Basins, Table 5. Much of this land is either in irrigated crops (rice) or in rangeland so that in either case this condition is not critical. Rangeland production, of course, will be lower due to this condition.

There are about 0.7 million acres in the Texas Coastal Basins on which lack of moisture is the limiting factor, Table 6. Practically, all of these soils are in the Lower Subarea. A developed source of irrigation water is needed.

Conservation Treatment for specific land use by land capability class and subclass is shown in Tables 7 through 11 for the basin.

Land Resource Development Potential

Land Availability and Suitability. The 1967 Conservation Needs Inventory shows the Texas Coastal Basins has 19,239,231 acres of agricultural land, Table 12. Sixty-eight percent of this land is suitable for continuous cultivation with proper soil and water conservation measures. Another 13 percent is suitable for limited cultivation with proper treatment. Only inventory land is considered potentially available for agricultural use.

TABLE 5

Inventory Land with an Unfavorable Soil Condition 1/
1967

Texas Coastal Basins

Subarea	Total Agricultural "s" Land	Cropland	Pastureland	Rangeland	Forest Land	Other
Upper	720,126	131,209	119,073	90,365	331,096	48,383
Middle	2,700,409	1,173,915	443,424	651,169	382,695	49,206
Lower	1,881,982	481,138	78,003	1,217,193	9,316	96,332
TOTAL	5,302,517	1,786,262	640,500	1,958,727	723,107	193,921

1/ Unfavorable soil conditions are indicated in land capability subclass "s" -- soils that limit root development or have low moisutre-holding capacity.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 6

Inventory Land with Climatic Hazard 1/
1967

Texas Coastal Basins

Subarea	Total "c"	Cropland	Pastureland	Rangeland	Forest Land	Other
Upper	0	0	0	0	0	0
Middle	1810	93	303	484	930	0
Lower	784,459	232,424	59,213	481,022	2,391	9,409
TOTAL	786,269	232,517	59,516	481,506	3,321	9,409

1/ Soils in which climate (lack of moisture) is the major hazard or limitation in their use.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 7

Conservation Treatment Needs for Cropland, 1967*

Texas Coastal Basins

Land Capability Class and Sub-Class	Total Cropland	Adequately Treated	Needing Treatment	NON IRRIGATED CROPLAND							IRRIGATED CROPLAND			
				Residue and Annual Cover	Sod in Rotation	Contour Only	Strip Cropping Terracing Diversions	Permanent Cover	Drainage	Total	Cultural Management Practices Only	Improved Systems	Water Management	Total
I	236275	84524	151751	82343	315	0	0	6679	22817	112154	2891	31658	5048	39597
IIE	310442	116981	193461	70723	7269	950	81377	17768	1720	179807	0	12602	1052	13654
IIIE	352560	124826	227734	81586	11133	837	76741	49407	848	220552	0	7182	0	7182
IVE	157610	33690	123920	30706	2713	236	19697	39645	2039	95036	6101	13584	9199	28884
VIE	34400	6525	27875	5640	507	0	443	19337	1530	27457	0	418	0	418
VIIE	6334	37	6297	421	0	0	249	5627	0	6297	0	0	0	0
IIW	313448	104145	209303	30962	0	0	0	997	49103	80962	24928	94167	9146	128241
IIIW	874902	134964	739938	53945	622	232	426	498	253369	309092	56810	374036	0	430846
IVW	71773	3378	68395	3889	0	0	0	10322	24711	39422	5820	19144	4009	28973
VW	40404	6184	34220	17604	1821	126	1947	8538	2863	32899	0	1321	0	1321
VIW	2586	920	1666	1666	0	0	0	0	0	1666	0	0	0	0
VIIW	1095	0	1095	0	0	0	0	0	260	260	0	835	0	835
IIS	1387308	420282	967026	362868	5732	1566	6545	26266	314467	717444	38439	209244	1899	249582
IIIS	362748	83874	278874	131193	9950	0	8699	16446	65980	232273	2854	40759	2988	46601
IVS	8454	459	7995	767	234	0	0	0	5637	6638	0	1357	0	1357
VS	2570	0	2570	2570	0	0	0	0	0	2570	0	0	0	0

*Treatment need is shown for the dominant or limiting constraint.

TABLE 7 (con't)

Conservation Treatment Needs for Cropland, 1967*

Texas Coastal Basins

Land Capability Class and Sub-Class	Total Cropland	Adequately Treated	Needing Treatment	NON IRRIGATED CROPLAND							IRRIGATED CROPLAND			
				Residue and Annual Cover	Sod in Rotation	Contour Only	Strip Cropping Terracing Diversions	Permanent Cover	Drainage	Total	Cultural Management Practices Only	Improved Systems	Water Management	Total
VIS	9286	0	9286	4408	0	0	0	4082	0	8490	394	402	0	796
VIIS	15896	7459	8437	19	0	0	1649	6769	0	8437	0	0	0	0
IIC	188967	87687	101280	91516	0	0	5439	1501	2824	101280	0	0	0	0
IIIC	35965	17578	18387	13777	0	0	0	3080	1530	18387	0	0	0	0
IVC	7585	3469	4116	4116	0	0	0	0	0	4116	0	0	0	0
TOTALS	4420608	1236982	3183626	990724	40296	3947	203212	217462	749698	2205339	138237	836709	33341	978287

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 8

Conservation Treatment Needs for Pastureland, 1967*

Texas Coastal Basins

Land Capability Class and Sub Class	Total	Treatment Adequate	Treatment Infeasible	Change in Land Use	Total Needing Treatment	TREATMENT NEEDS						
						IMPROVE VEGETATIVE COVER				REESTABLISH VEGETATIVE COVER		
						Protection Only	Improvement Only	Brush Control and Improvement	Total	Reestablishment Only	Brush Control and Reestablishment	TOTAL
I	347461	133963	0	0	213498	56590	115064	10168	181822	29113	2563	31676
IIE-IVE	824952	236187	1933	220	586612	160630	225172	52361	438163	79521	68928	148449
IIW-IVW	729244	146036	711	0	582437	95305	395091	8891	499287	61283	21867	83150
IIS-IVS	613692	138773	3194	0	471725	175345	199356	28213	402914	42912	25092	68004
IIC-IVC	59516	40277	27	0	19212	905	7001	1328	9234	0	9978	9978
VE-VIIIE	43857	7248	315	0	41294	9254	20927	1981	32172	4924	4198	9122
VI-VIIIW	135391	31637	773	0	102981	18225	45702	10939	74866	7775	20340	28115
VS-VIIIS	26808	17680	0	0	9128	1460	3318	1590	6368	2397	363	2760
TOTALS	2735921	751861	6953	220	2026887	517724	1011631	115471	1644826	227930	154131	382061

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 9

Conservation Treatment Needs for Rangeland, 1967 *

Texas Coastal Basins

Land Capability Class and Sub Class	Total	Treatment Adequate	Treatment Infeasible	Change in Land Use	Total Needing Treatment	TREATMENT NEEDS						
						IMPROVE VEGETATIVE COVER				REESTABLISH VEGETATIVE COVER		
						Protection Only	Improvement Only	Brush Control and Improvement	Total	Reestablishment Only	Brush Control and Reestablishment	Total
I	99691	27691	0	0	72000	21238	7093	40805	69136	2081	783	2864
IIE-IVE	2412726	486889	2272	0	1923565	140612	143408	295099	581119	88735	1250711	1339446
IIW-IVW	485729	93294	319	0	392115	162341	58550	91529	312420	11688	68007	79695
IIS-IVS	1396425	289025	1916	0	1105484	169221	168307	373383	710911	46768	347805	394573
IIC-IVC	481506	49067	1473	0	430966	39560	7046	10028	56634	20966	353366	374332
VE-VIIIE	1076978	459309	14855	0	602814	69494	46174	34526	150194	13923	438697	452620
VI-VIIIW	683832	376057	30430	0	277345	69388	34135	52303	155826	11058	110461	121519
VS-VIIIS	562302	120280	12921	0	429101	95431	8063	18415	121909	29411	277781	307192
TOTALS	7199188	1901612	64186	0	5233390	767285	477776	916088	2161149	224630	2847611	3072241

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 10

Conservation Treatment Needs for Forest Land, 1967*

Texas Coastal Basins

COUNTY	COMMERCIAL FOREST				NON-COMMERCIAL FOREST			TOTAL FOREST			
	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Timber Stand Improve-ment	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Timber Stand Improve-ment
Aransas	0	0	0	0	10570	10570	0	10570	10570	0	0
Austin**	51380	0	16574	34806	0	0	0	51380	0	16574	34806
Bee	0	0	0	0	5585	5585	0	5585	5585	0	0
Brazoria	0	0	0	0	176289	176289	0	176289	176289	0	0
Brooks	0	0	0	0	0	0	0	0	0	0	0
Calhoun	0	0	0	0	0	0	0	0	0	0	0
Chambers	35400	5000	3500	26900	0	0	0	35400	5000	3500	26900
Colorado**	5624	0	1954	3670	140348	140348	0	145972	140348	1954	3670
DeWitt**	0	0	0	0	62577	62577	0	62577	62577	0	0
Duval**	0	0	0	0	0	0	0	0	0	0	0
Fayette**	5640	200	2240	3200	24440	24440	0	30080	24640	2240	3200
Fort Bend	0	0	0	0	77243	77243	0	77243	77243	0	0
Galveston	0	0	0	0	5073	5073	0	5073	5073	0	0
Goliad**	0	0	0	0	167627	167627	0	167627	167627	0	0
Gonzales**	462	462	0	0	1386	1386	0	1848	1848	0	0
Grimes**	43132	9260	7971	25901	30120	30120	0	73252	39380	7971	25901
Hardin	501600	158175	102600	240825	0	0	0	501600	158175	102600	240825
Harris	162264	32110	41154	89000	0	0	0	162264	32110	41154	89000

*Treatment need is shown for the dominant or limiting constraint.
**Denotes Partial County in Study Area

TABLE 10 (cont'd)

Conservation Treatment Needs for Forest Land, 1967*

Texas Coastal Basins

COUNTY	COMMERCIAL FOREST				NON-COMMERCIAL FOREST			TOTAL FOREST			
	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Timber Stand Improve-ment	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Timber Stand Improve-ment
Jackson	0	0	0	0	67489	67489	0	67489	67489	0	0
Jasper**	183020	68450	32024	82546	0	0	0	183020	68450	32024	82546
Jefferson	54400	10000	0	44400	0	0	0	54400	10000	0	44400
Jim Hogg**	0	0	0	0	0	0	0	0	0	0	0
Jim Wells	0	0	0	0	0	0	0	0	0	0	0
Karnes**	0	0	0	0	32	32	0	32	32	0	0
Kenedy	0	0	0	0	0	0	0	0	0	0	0
Kleberg	0	0	0	0	0	0	0	0	0	0	0
Lavaca**	12701	12701	0	0	147184	147184	0	159885	159885	0	0
Liberty	453600	96475	40800	316325	0	0	0	453600	96475	40800	316325
Live Oak**	0	0	0	0	6625	6625	0	6625	6625	0	0
Matagorda	0	0	0	0	96841	96841	0	96841	96841	0	0
McMullen**	0	0	0	0	0	0	0	0	0	0	0
Montgomery	497169	140160	133824	223185	0	0	0	497169	140160	133824	223185
Nueces	0	0	0	0	0	0	0	0	0	0	0
Orange**	65250	18450	7650	39150	0	0	0	65250	18450	7650	39150
Polk**	347910	106873	88034	153003	0	0	0	347910	106873	88034	153003
Refugio	0	0	0	0	21591	21591	0	21591	21591	0	0

*Treatment need is shown for the dominant or limiting constraint.
**Denotes Partial County in Study Area

TABLE 16 (cont'd)

Conservation Treatment Needs for Forest Land, 1967*

Texas Coastal Basins

COUNTY	COMMERCIAL FOREST				NON-COMMERCIAL FOREST			TOTAL FOREST			
	Total	Treatment Adequate	Establishment and Reinforcement	Timber Stand Improvement	Total	Treatment Adequate	Establishment and Reinforcement	Total	Treatment Adequate	Establishment and Reinforcement	Timber Stand Improvement
San Jacinto**	128465	48675	33040	46750	0	0	0	128465	48675	33040	46750
San Patricio	0	0	0	0	8769	8769	0	8769	8769	0	0
Starr**	0	0	0	0	0	0	0	0	0	0	0
Tyler**	348790	103640	84196	160954	0	0	0	348790	103640	84196	160954
Victoria	0	0	0	0	6003	6003	0	6003	6003	0	0
Walker**	166239	42640	44016	79583	0	0	0	166239	42640	44016	79583
Waller	28200	11365	11577	5258	33000	33000	0	61200	44365	11577	5258
Washington**	0	0	0	0	26040	26040	0	26040	26040	0	0
Webb**	0	0	0	0	0	0	0	0	0	0	0
Wharton	0	0	0	0	76804	76804	0	76804	76804	0	0
TOTALS	3091246	864636	651154	1575456	1191636	1191636	0	4282882	2056272	651154	1575456

*Treatment need is shown for the dominant or limiting constraint.
**Denotes Partial County in Study Area

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 11

Conservation Treatment Needs for Other Land, 1967*

Texas Coastal Basins

COUNTY	IN FARMS			NOT IN FARMS			TOTAL - OTHER LAND		
	Total	Need Treatment	Treatment Adequate	Total	Need Treatment	Treatment Adequate	Total	Need Treatment	Treatment Adequate
Aransas	196	0	196	31100	0	31100	31296	0	31296
Austin**	23567	14500	9067	4009	2658	1351	27576	17158	10418
Bee	4340	2112	2228	1738	1114	624	6078	3226	2852
Brazoria	2415	1002	1413	5634	2004	3630	8049	3006	5043
Brooks	1632	940	692	1632	210	1422	3264	1150	2114
Calhoun	6472	2588	3884	24216	9686	14530	30688	12274	18414
Chambers	5461	3932	1529	15071	13542	1529	20532	17474	3058
Colorado**	5067	0	5067	2217	0	2217	7284	0	7284
DeWitt**	1522	298	1224	762	60	702	2284	358	1926
Duval**	5482	1382	4100	2055	1235	820	7537	2617	4920
Fayette**	1467	354	1113	349	242	107	1816	596	1220
Fort Bend	5834	1747	4087	3749	938	2811	9583	2685	6898
Galveston	1522	700	822	21305	11000	10305	22827	11700	11127
Goliad**	8431	2920	5511	1945	0	1945	10376	2920	7456
Gonzales**	160	34	126	16	0	16	176	34	142
Grimes**	197	40	157	1577	158	1419	1774	198	1576
Hardin	1248	0	1248	12476	0	12476	13724	0	13724
Harris	19566	15000	4566	14298	10000	4298	33864	25000	8864

*Treatment need is shown for the dominant or limiting constraint.
**Denotes Partial County in Study Area

TABLE 11 (cont'd)

Conservation Treatment Needs for Other Land, 1967*

Texas Coastal Basins

COUNTY	IN FARMS			NOT IN FARMS			TOTAL - OTHER LAND		
	Total	Need Treatment	Treatment Adequate	Total	Need Treatment	Treatment Adequate	Total	Need Treatment	Treatment Adequate
Jackson	1704	175	1529	213	15	198	1917	190	1727
Jasper**	444	74	370	370	111	259	814	185	629
Jefferson	6129	2075	4054	25389	18673	6716	31518	20748	10770
Jim Hogg**	333	134	199	108	56	52	441	190	251
Jim Wells	2016	0	2016	0	0	0	2016	0	2016
Karnes**	677	530	147	73	73	0	750	603	147
Kenedy	3310	0	3310	65135	0	65135	68445	0	68445
Kleberg	1594	0	1594	9283	0	9283	10877	0	10877
Lavaca**	14584	2874	11710	1620	332	1288	16204	3206	12998
Liberty	6799	300	6499	1275	277	998	8074	577	7497
Live Oak**	9168	5396	3772	142	71	71	9310	5467	3843
Matagorda	3839	0	3839	10240	0	10240	14079	0	14079
McMullen**	37	19	18	0	0	0	37	19	18
Montgomery	953	318	635	12866	3216	9650	13819	3534	10285
Nueces	10654	0	10654	30824	13000	17824	41478	13000	28478
Orange**	675	315	360	3152	1575	1577	3827	1890	1937
Polk**	310	186	124	310	155	155	620	341	279
Refugio	9135	300	8835	2610	150	2460	11745	450	11295

*Treatment need is shown for the dominant or limiting constraint.
**Denotes Partial County in Study Area

TABLE 11 (cont'd)

Conservation Treatment Needs for Other Land, 1967*

Texas Coastal Basins

COUNTY	IN FARMS			NOT IN FARMS			TOTAL - OTHER LAND		
	Total	Need Treatment	Treatment Adequate	Total	Need Treatment	Treatment Adequate	Total	Need Treatment	Treatment Adequate
San Jacinto**	506	379	127	632	126	506	1138	505	633
San Patricio	16499	0	16499	14312	0	14312	30811	0	30811
Starr**	287	239	48	192	168	24	479	407	72
Tyler**	1082	780	302	270	195	75	1352	975	377
Victoria	8682	129	8553	2840	43	2797	11522	172	11350
Walker**	887	710	177	1775	1420	355	2662	2130	532
Waller	6543	1820	4723	1753	705	1048	8296	2525	5682
Washington**	898	898	0	514	258	256	1412	1156	5771
Webb**	819	483	336	614	246	368	1433	729	704
Wharton	15103	5001	10102	1725	700	1025	16828	5701	11127
TOTALS	218246	70684	147562	332386	94412	237974	550632	165186	385446

*Treatment need is shown for the dominant or limiting constraint.
**Denotes Partial County in Study Area

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 12

Land Use by Capability Class Summary, 1967

Texas Coastal Basins

Land Capability Class	Total Agricultural Land Acres	Cropland Acres	Pastureland Acres	Rangeland Acres	Forest Land Acres	Other Acres	Distribution Percent
I	839920	236275	347461	99691	136737	19756	4.3
II	5908597	2200165	975409	1327634	1272369	133020	30.5
III	6418746	1626175	944648	2453966	1267444	126513	33.1
Subtotal	13167263	4062615	2267518	3881291	2676550	279289	67.9
IV	2465126	245422	307347	1019977	853352	39028	12.8
Subtotal	2465126	245422	307347	1019977	853352	39028	12.8
V	915712	42974	97000	531502	215606	28630	4.7
VI	1642013	46272	91471	928905	525940	49425	8.6
VII	949428	23325	22177	805460	11434	87032	5.1
VIII	99689	0	408	32053	0	67228	0.9
Subtotal	3606842	112571	211056	2297920	752980	232315	19.3
TOTAL	19239231	4420608	2785921	7199188	4282882	550632	100.0

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

This survey revealed 15,632,389 acres in Classes I through IV. The soil in this area is deemed suitable for cultivation when managed within their capabilities. Class I land, which is suitable for continuous cultivation requiring only good cultural practices, accounts for 839,920 acres; 5,908,597 acres are Class II land which has certain limitations such as wetness that restricts the choice of plants and requires a moderate level of conservation treatment; 6,418,746 acres are Class III land which has greater limitations which restrict the choice of cultivated crops and require special conservation treatment; 2,465,126 acres are Class IV land with soils having very severe limitations that restrict the choice of plants and require very careful management.

There are 3,606,842 acres in Classes V through VIII. These soils are better suited for grassland and forest land because of the risk of damage during cultivation. The limitations are usually impractical or infeasible to eliminate.

Cropland Suitable for Regular Cultivation. There are 4,420,608 acres of land now supporting cultivated crops. Over 92 percent of these acres are on soils with a capability class of I, II, or III. There is also 245,422 acres of Class IV in cropland. An additional 9 million acres of soils in capability Classes I - III in other uses could be cultivated with an acceptable level of risk.

Potential for Shift of Grassland to Cropland. There are an estimated 6.1 million acres in grassland (pasture and range) suited for continuous cultivation. Much of this acreage could be put into cultivation by turning under the sod and applying good management practices. The remainder would require the application measures to eliminate wetness or protect from erosion.

Potential for Shift from Forest Land to Cropland. There are an estimated 136,700 acres of Class I land in forest which could be readily converted to cropland by clearing the woody vegetation. Another 1.3 million acres is in capability Class II. Class III also contains about 1.2 million acres. An aggregate of 2.6 million acres is suited for continuous cultivation. An additional 853,000 acres of Class IV land could be converted to cropland if special soil and water conservation measures are applied. The risks are greater and the choice of crops is limited.

Potential for Shift from Cropland to Grazing Land and Forest Land. There is about 112,500 acres of cropland containing soils generally not suited for cultivation. This small acreage would indicate stability in the cropland base on Classes I - IV land. There is little potential for this type of land use adjustment.

Other Land. The choice of land for this category depends, primarily on location rather than soil suitability.

Conclusion

Two factors indicate there is an ample supply of suitable soils for cropland to meet present demand. First, 97 percent of the acreage in crops is found on land that is either Class I, II, III, or IV. Secondly, there is nearly 9 million acres of Class I through III agricultural and forest land which could be put into cultivation if the demand develops. Also, there is nearly two million acres in Class IV agricultural and forest land which could be used to grow selected crops with very specific soil and water conservation measures.

UPPER SUBAREA

Description

This hydrologic evaluation unit is located in southeast Texas and includes the metropolitan areas of Houston, Galveston-Texas City, Beaumont, and Port Arthur. It includes all of the basins between and including the San Jacinto-Brazos Coastal and Neches River Basin (Plate 4).

The 10,708 square mile area includes all or part of the following counties: Brazoria, Chambers, Fort Bend, Galveston, Grimes, Hardin, Harris, Jasper, Jefferson, Liberty, Montgomery, Orange, Polk, San Jacinto, Tyler, Walker, and Waller.

The climate is generally described as subtropical which means adequate precipitation throughout the year, a mild but definite winter season, and warm to hot summers accompanied by high humidity. The tempering effect of the Gulf dissipates rapidly inward but is still the dominant influence throughout the study area. The growing season ranges from 335 days at Galveston to 229 days at Jasper. The average annual rainfall varies from 56 inches at Beaumont to 40 inches in Walker County. The mean annual temperature is about 68 degrees F.

LEGEND

- Interstate Highway
- U S Highway
- State Highway
- Farm to Market Road
- Interstate Highway
- Paved Road
- City Limits
- Towns
- County Seat
- County Line
- State Line
- Drainage
- Basin Boundary

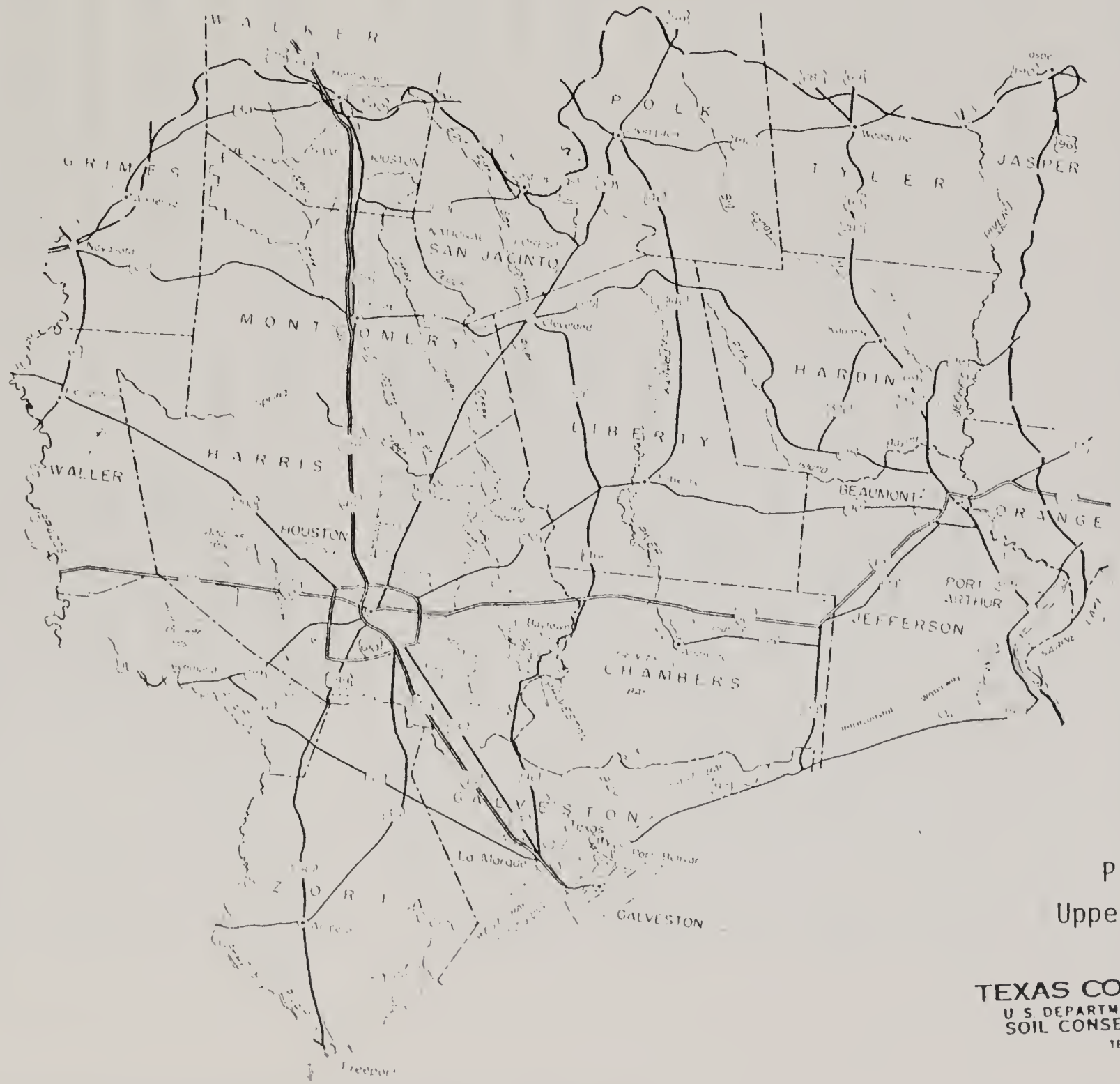


Plate 4

Upper Subarea

TEXAS COASTAL BASINS

U S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

Gould (1) describes three vegetational areas in the Upper Subarea. They are Pineywoods, Gulf Prairies and Marshes, and Blackland Prairies. The Soil Conservation Service separated Bottom land out of these vegetational areas because of its unique and fragile properties (Plate 5).

The "Pineywoods" is generally occupied by a pine hardwood forest with pine dominating the ridges and hardwoods increasing on poorly drained nearly level areas. Major softwood species are loblolly, slash, longleaf, and shortleaf pine. Along with the pines in the overstory are hardwoods such as hickory, maple, sweetgum, red oak, and white oak. The understory is a complex association of brush and forb species including American beautyberry, coral berry, haw, and grapevines. The dominant grasses are bluestems, dropseeds, panicum, and Indiangrass. Due to ecological disturbance such as discontinuing the use of fire and improper grazing techniques the area has been invaded by yaupon, greenbriar, and yankeeweed.

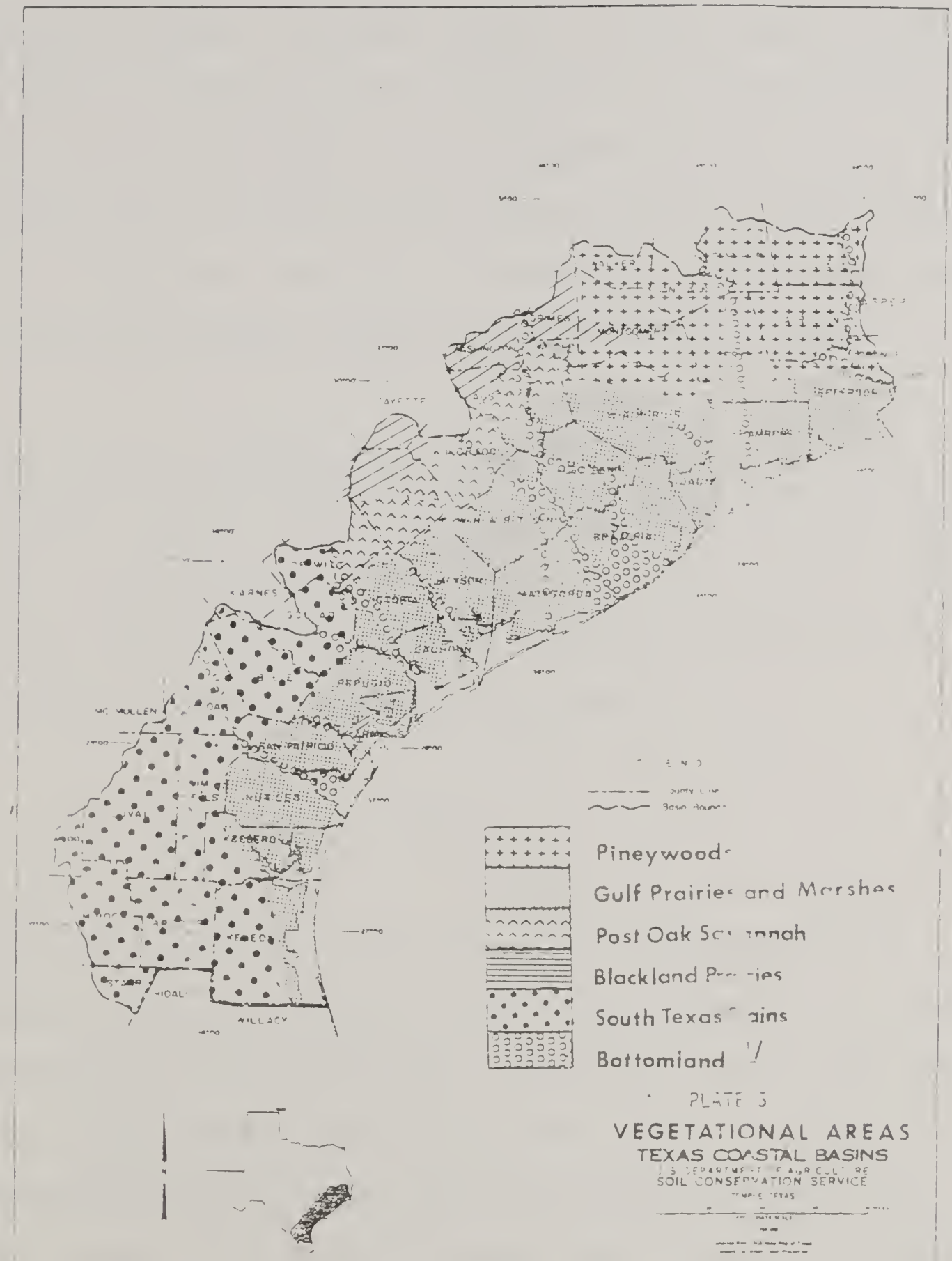
The Gulf Prairies and Marshes are described separately. Vegetation on the Gulf Prairies is dominated by bluestems and paspalums. Bermuda and carpetgrass are also common. Most of the Gulf Prairies are or have been in cultivation. The Gulf Marshes are generally described according to the composition of vegetative communities which are governed by the salinity, depth, frequency, and duration of inundation. Maidencane, sawgrass, bulrush, and cattails are the dominant plants in the fresh marsh. As salinity increases generally cordgrass, saltgrass, and common reed increase in relation to the factors mentioned above.

Bottom land is generally defined as the flood plain of a river. The alluvial soil supports diverse vigorous plant communities. Oak, gum, cypress, beech, and pine provide an overstory for haw, greenbriar, Virginia wildrye, palmetto, and numerous fruit-bearing vine and shrubs.

Three major rivers traverse the subarea generally in a north to south direction. These streams and their tributaries are well dissected in the upper part of the study area. As they meander onto the coastal plain their flood plains become poorly defined. Major water impoundments include Lakes Conroe and Houston, and Sheldon Reservoir.

The population of the study segment is 2,428,910 people. About 1.7 million of these people live in Harris County. Since 1970 Harris County has grown at the rate of 31,000 people annually. Seventy-six percent of the 1970 population in the Texas Coastal Basins live in this subarea. Projections indicate this will continue to be one of the fastest growing areas in the state.

The economy of the subarea is almost a model of diversification. Forest products, oil, gas, rice, and livestock are processed into an assortment of consumer goods. Seaports at Houston, Galveston, Port Arthur, and Beaumont provide the facilities for world trade. The intercoastal waterway also facilitates the movement of barge



1/ The area depicted as Bottom land is shown separate since the vegetation in these areas is distinctively different from that in the remaining vegetational area.

Source: Texas Plants-A Check List and Ecological Summary-F.W. Gould, 1962

railroad routes, as well as three interstate highways, provide for overland transportation of goods, services, and people.

Recreation centers around Gulf related activities such as sunbathing, swimming, and fishing. With such attractions as the Astrodome, Astroworld, San Jacinto Monument and Battleground, and the National Aeronautics and Space Administration, sight seeing is a popular activity. Other recreational facilities are discussed in the Special Report, "Outdoor Recreational Resources in the Texas Coastal Basins".

Wildlife species include deer, dove, turkey, quail, fox, bobcat, armadillo, rabbit, racoon, opossum, and squirrel. Duck and geese feed on the coastal prairies and rest in the bays and Gulf. Additional information is contained in the Special Report "Fish and Wildlife Resources in the Texas Coastal Basins".

Soils

The soils range from a surface layer of clay loam in the Gulf Coast Prairies Land Resource Area to sandy surfaces in the Southern Coastal Plain Land Resource Area. Gulf Coast Prairies soils are very slowly permeable and somewhat poorly drained. Soils of the Southern Coastal Plain are generally moderately permeable and well drained. Additional information may be found in the report "Soils of the Texas Coastal Basins".

The distribution of land by capability class is shown in Figure 4. The capability class is a practical grouping to reflect the natural limitation of the soil, the risk of damage in use, its response to use. Cultivation, the most intensive use, is the baseline for comparison of capability classes. Classes I through III can generally be used for cultivation continuously with only normal management practices needed to prevent deterioration of soil properties. Class IV land can be used for occasional cultivation but needs definite safeguards to prevent deterioration of soil characteristics. Classes V - VIII are not suited for cultivation because of severe limitations and risks. Refer to pages 29 to 32 for a description of each class.

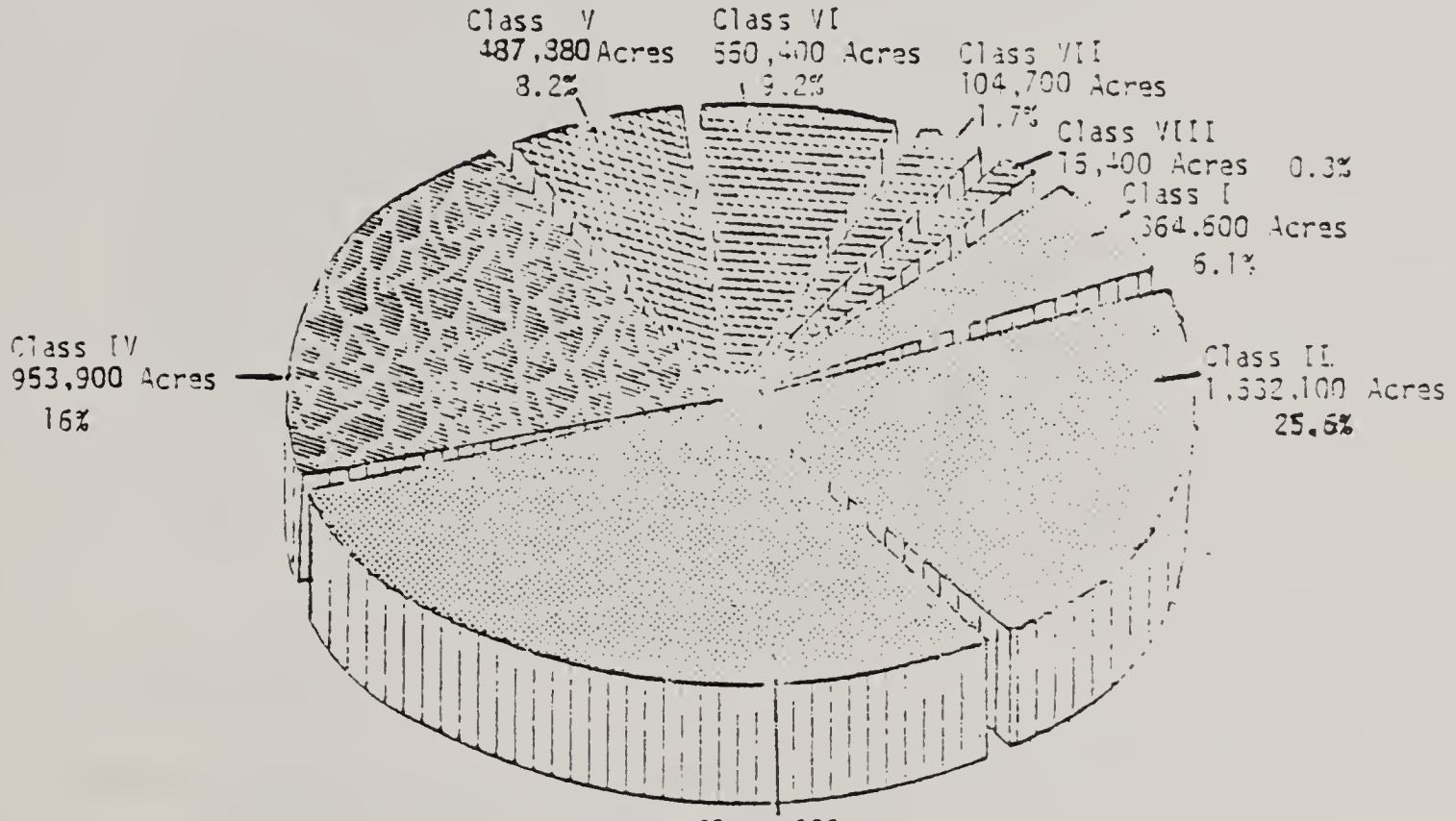
Land Use

The land area in the Upper Subarea is 6,853,342 acres. Water area (over 40 surface acres) accounts for an additional 437,920 acres. The land uses are separated into agricultural land use (inventory land) and non-agricultural land use (non-inventory land). Agricultural land use categories are cropland, pastureland, rangeland, forest land, and other. Non-agricultural uses are urban built-up and federal, which includes National Forests. The present agricultural land use distribution is illustrated in Figure 5. General land use is shown in Plate 2.

FIGURE 4

Land Capability Classes for Agricultural Land, 1967

Upper Subarea, Texas Coastal Basins



SUITED FOR CONTINUOUS CULTIVATION, 3,862,300 ACRES

SUITED FOR LIMITED CULTIVATION, 972,700 ACRES

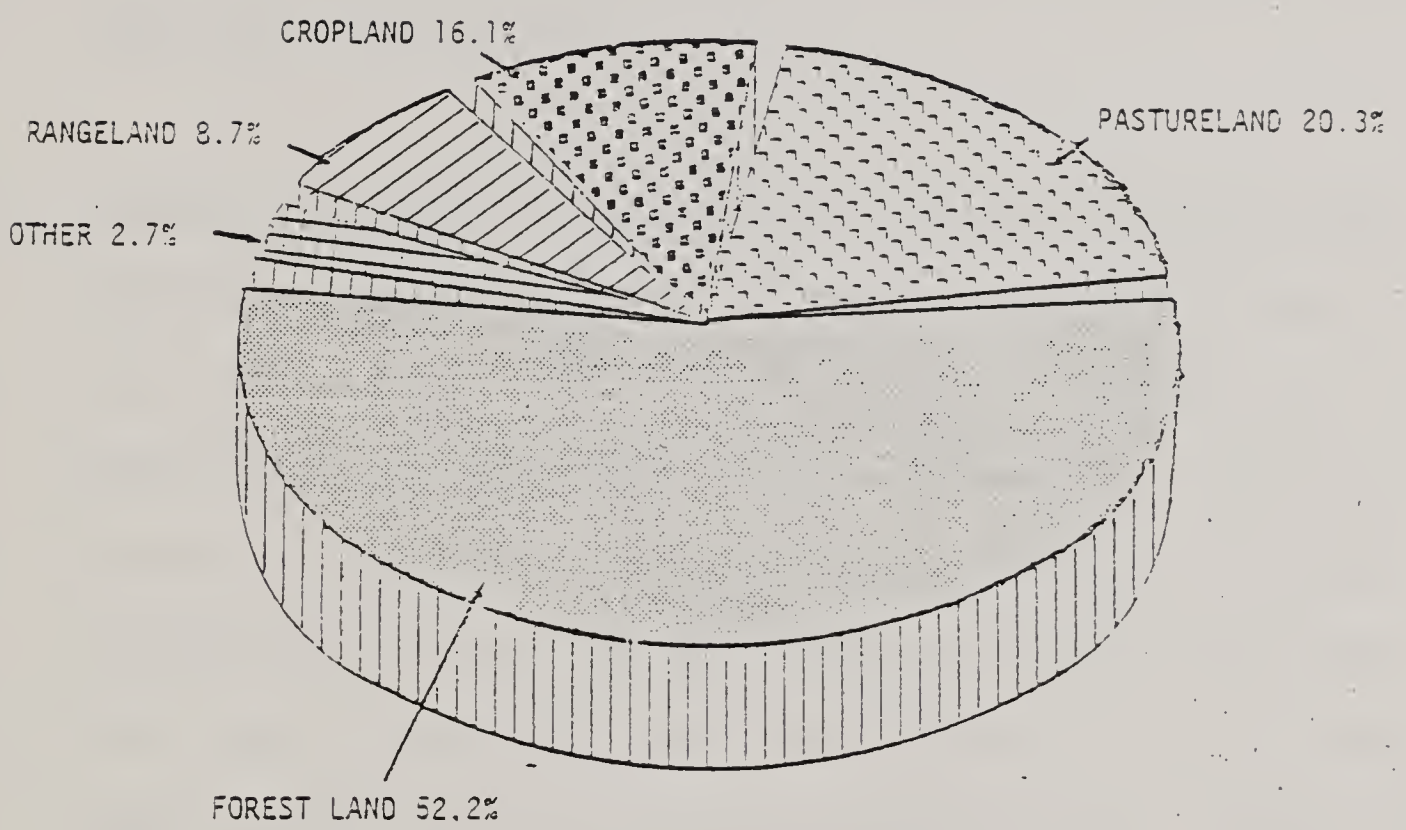
NOT SUITED FOR CULTIVATION, 1,161,300 ACRES

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

FIGURE 5

Agricultural Land Use, 1967

Upper Subarea, Texas Coastal Basins



Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

Cropland

The Conservation Needs Inventory revealed there were 965,412 acres of cropland in the subarea in 1967. Irrigated cropland accounts for 524,164 acres while dry cropland occupies 441,248 acres. Major cultivated crops are rice, grain sorghum, and soybeans. Figure 6 shows major crops planted in 1973.

Irrigated cropland is land on which irrigation water has been applied by an adapted irrigation system at least two years out of the past five years. Rice is the principal irrigated crop even though other crops may be receiving supplemental irrigation water. The rice allotment for the upper coastal subarea in 1973 was 247,731 acres. Rice is normally grown on the same land every other year or every third year. The land base for rice production would be about five to six hundred thousand acres. Surface water is the principal source of irrigation. Canal companies deliver water in Liberty, Chambers, Jefferson, Brazoria, and Fort Bend counties while ground water is used almost exclusively in northwest Harris County and Waller County.

Major crops which are not irrigated systematically include corn, grain sorghum, and soybeans. In 1973 there were 108,049 acres planted to these crops with soybeans accounting for 154,359 acres. Soybeans, which fit well in a rice rotation have increased to a

significant acreage in this decade. The remaining 200,000 acres in dry cropland is in ideal cropland, cropland pasture, and miscellaneous crops.

The Conservation Needs Inventory expressed conservation treatment needs of cropland in terms of the problems limiting the capability of the land. All land, except Class I land, has a problem of erosion, excess water, or unfavorable soil conditions serious enough to impose limits on its use. Various conservation treatment practices are required to minimize the effects of these hazards.

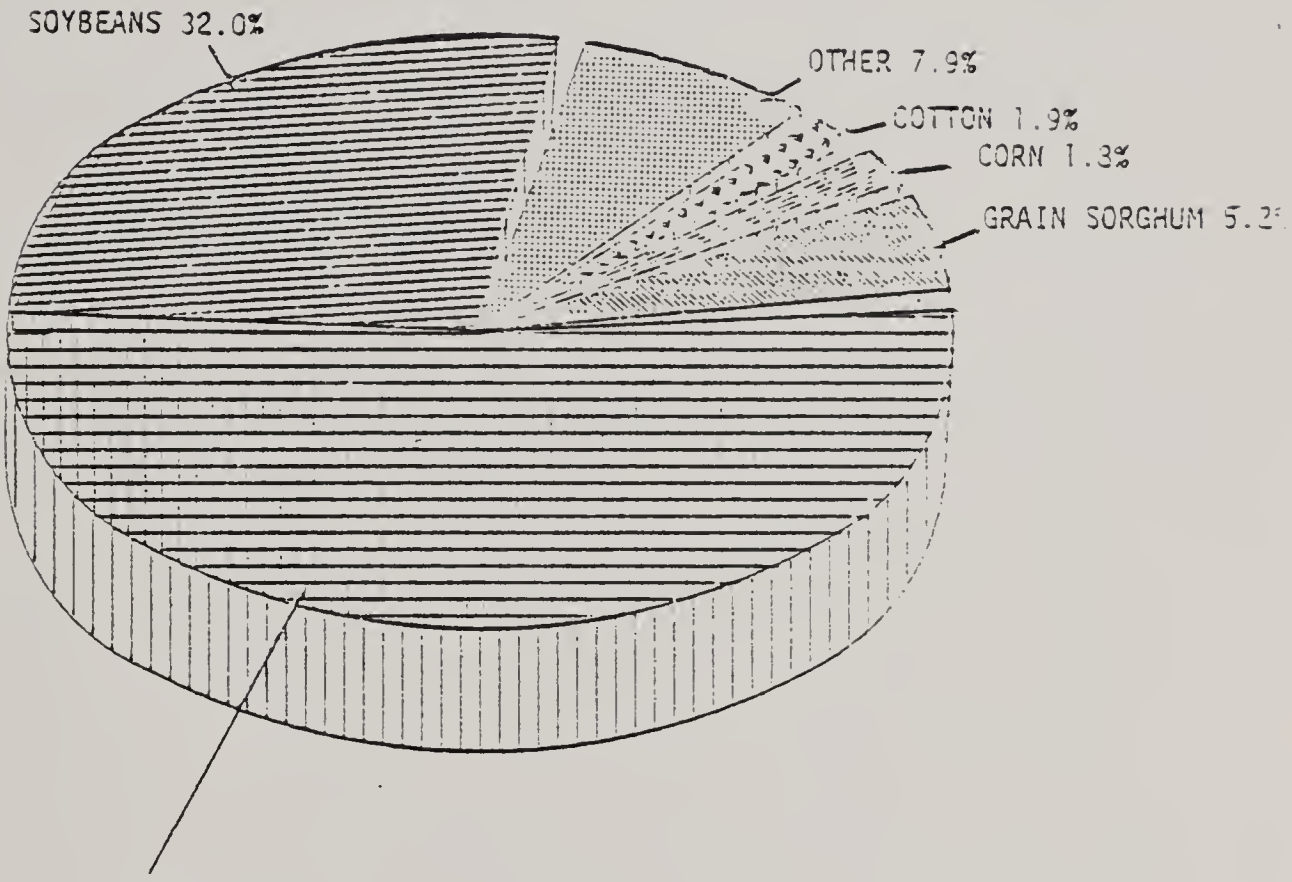
Table 13 shows conservation treatment needs by capability class and subclass. Estimates of treatment needs were based on land capability data as well as the intensity of the crop enterprise. To avoid duplication of acreage in these estimates, the acreage of each needed practice is mutually exclusive. Even though problems occur in combinations, only the more severe problem is in the acreage estimates of treatment needs. Therefore, more information should be obtained for detailed planning on a specific area.

Twenty-one percent of the cropland is adequately treated -- that is the current conservation treatment is adequate to alleviate the resource problems. This acreage will require continued maintenance of established practices. Of the remaining 759,000 acres of cropland needing conservation treatment, 268,000 acres are non-irrigated

FIGURE 6

Major Crops Planted, Upper Subarea. 1/

Texas Coastal Basins



1/ From 1973 Texas County Statistics

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 13

Conservation Treatment Needs for Cropland in the Upper Subarea, 1967*

Texas Coastal Basins

Land Capability Class and Sub-Class	Total Cropland	Adequately Treated	Needing Treatment	NON IRRIGATED CROPLAND							IRRIGATED CROPLAND			
				Residue and Annual Cover	Sod in Rotation	Contour Only	Strip Cropping Terracing Diversions	Permanent Cover	Drainage	Total	Cultural Management Practices Only	Improved Systems	Water Management	Total
I	50,661	22,658	28,003	18,373	35	0	0	1,606	5,734	25,748	193	2,062	0	2,255
IIE	24,953	5,434	19,519	4,851	455	0	2,511	664	124	8,605	0	10,914	0	10,914
IIIE	25,406	11,046	14,360	8,392	881	61	4,417	560	49	14,360	0	0	0	0
IVE	12,295	2,663	9,542	3,558	0	0	1,536	1,300	0	6,394	648	1,736	764	3,148
VIE	957	182	775	107	0	0	0	668	0	775	0	0	0	0
IIW	166,914	59,392	107,522	21,543	0	0	0	165	15,797	37,505	15,982	53,065	970	70,017
IIIW	528,725	83,017	445,708	8,466	409	0	0	0	105,719	114,594	51,824	279,290	0	331,114
IVW	19,949	457	19,492	465	0	0	0	9,520	4,110	14,095	618	1,848	2,931	5,397
VW	3,537	1,574	1,963	427	21	0	0	486	616	1,550	0	413	0	413
VIW	636	548	88	88	0	0	0	0	0	88	0	0	0	0
VIIW	260	0	260	0	0	0	0	0	260	260	0	0	0	0
IIS	120,081	17,767	102,314	16,424	41	0	324	4,247	14,550	35,586	16,747	49,981	0	66,728
IIIS	7,361	1,638	5,723	1,722	517	0	121	3,363	0	5,723	0	0	0	0
IVS	168	0	168	127	41	0	0	0	0	168	0	0	0	0
VIS	3,599	0	3,599	2,170	0	0	0	1,228	0	3,398	201	0	0	201
TOTAL	965,412	206,376	759,036	86,713	2,400	61	8,909	23,807	146,959	268,849	86,213	399,309	4,665	490,187

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

cropland, and 490,000 acres are irrigated. The first five treatment needs categories for non-irrigated cropland are arranged in order of increasing severity of conservation problems. Residue and annual cover is the least critical treatment whereas permanent cover is usually prescribed for an area with a critical conservation problem. Slightly more than half the non-irrigated cropland needs drainage while the next most pressing need is for residue and annual cover.

Conservation problems on irrigated cropland are very complex. Three categories of treatment are shown in Table 13. Cultural management practices are measures needed to maintain or improve the air, water, and soil relationship. The need for improved irrigation water delivery systems embraces a group of measures and is based upon the ability of the system to deliver adequate water in a timely manner to the point of use. These measures include drainage, land leveling, and erosion control measures. About 65 percent of the irrigated cropland in this subarea needs improvement of irrigation systems.

The last category is proper water management which deals with the efficiency of operating the irrigation system. Generally, a properly designed system must be installed before proper water management can occur.

This analysis revealed 95 percent of the land being used for cropland is in Land Capability Classes I - III. Land in this category

can generally be cultivated regularly, using good management, with minimum risk of soil property degradation. As would be expected on a coastal plain, the dominant conservation problem is wetness. This condition occurs as accumulated surface water and excessive moisture in the soil profile.

Pastureland

The Upper Subarea has 1.2 million acres of pastureland according to the 1967 Conservation Needs Inventory. These pastures are comprised of introduced plants which are adapted to the local environment and managed primarily for forage production. The same plants which are best adapted for livestock production, when properly managed, are usually good plants adequate for soil and water conservation.

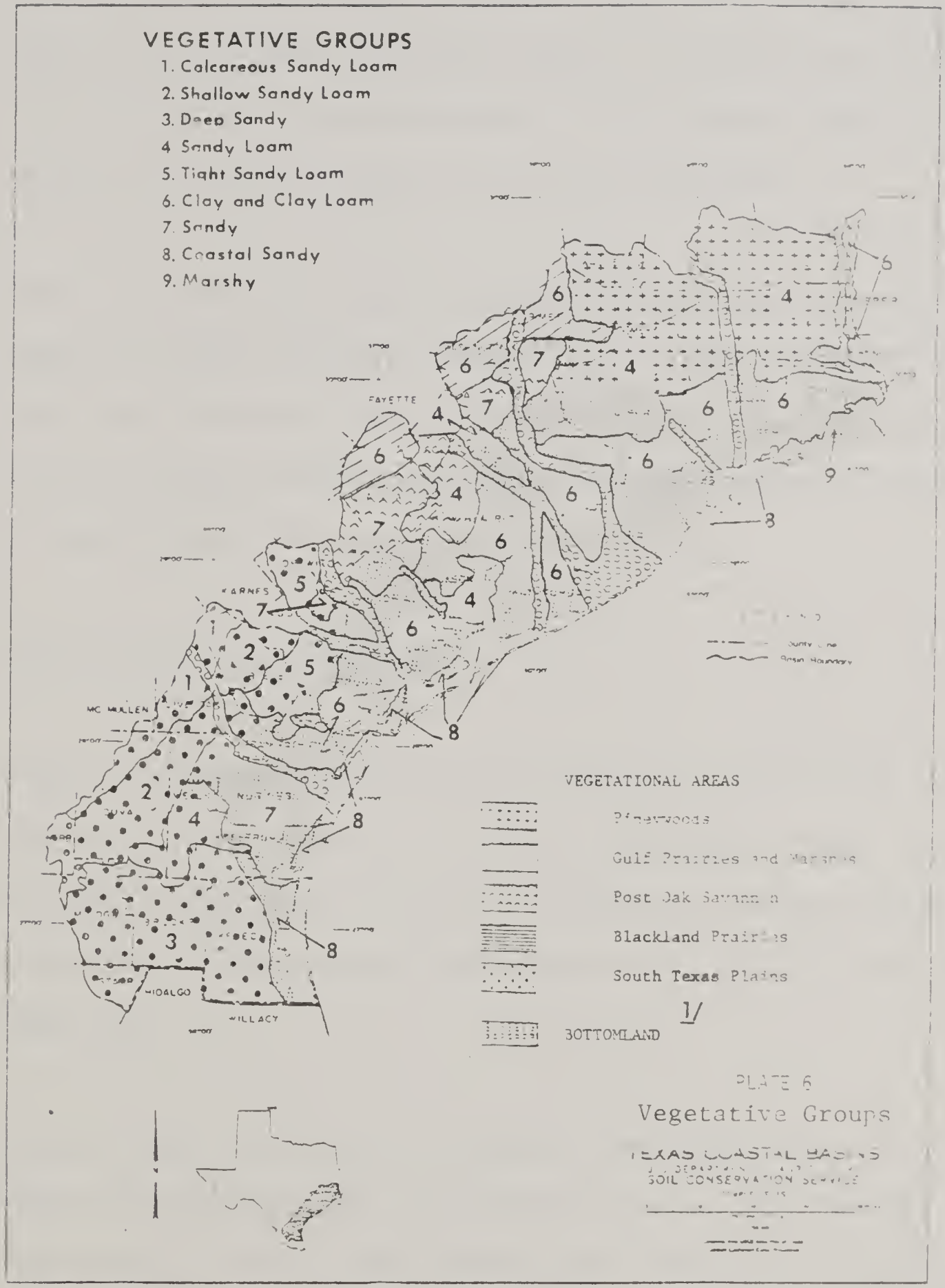
Pastures of introduced grasses are a very important part of the grazing scheme in the Upper Subarea. Technological advances, new grass species, improved management techniques, and agents to selectively control undesirable plants have enhanced the management of pastures. Also more owners of small units, who have the financial ability, are intensifying forage production. Often, the increasing tax burden, which has traditionally been assigned to the land, is the motivating factor to improve the productivity of pastures.

Gould (1) describes three vegetational areas in the Upper Subarea. These include Pineywoods, Gulf Prairies and Blackland Prairies. The pastureland in the Upper Subarea will be discussed according to these vegetational areas. Also the pastureland in the Bottom land will be discussed separately. Bottom land was separated from these vegetational areas because of its unique properties. These vegetational areas were disaggregated into vegetative groups, generally according to homogenous soils (Plate 6).

Pineywoods Vegetational Area

There are approximately 480,000 acres of pastureland intermingled throughout the forest land. Some areas were cleared for cropland many years ago, found to be marginal, then sodded to improve pasture grasses. Other areas now in pasture were cleared specifically to plant forage plants for livestock. This landowner decision is often personal preference but quite often it is related to the mediocre performance of wood-producing species. It is common for a livestock producer whose cattle graze large acreages of woodland to clear smaller areas and plant them to high-yielding forage plants for hay or use during crucial periods of need.

Generally, all of the pastureland in this vegetational area is found on the sandy loam vegetative group (Plate 6). Topography affects forage production in this unit. The rolling land is well



1/ Although Bottom land is a portion of each of these vegetational areas, it is shown separately because it is discussed as a separate unit in the narrative.

Source: Texas Plants-A Check List and Ecological Summary-F. W. Gould. 1962. United States Department of Agriculture, Soil Conservation Service

drained, in fact, it often becomes droughty in the summer. The relatively flat area usually has a perched water table which inhibits optimum production. Operating units, which average about 300 acres each, generally utilize coastal bermudagrass and pensacola bahiagrass as pasture plants. Fertilizer and lime must be applied for sustained high quality forage production.

This is a forest climax area, therefore, a continuous struggle is waged to control encroaching woody plants. There is a need for a cool season perennial plant which will furnish grazing and protect the soil between November and March. The average annual production is approximately 200 pounds of beef per acre.

Gulf Prairies Vegetational Area

There are approximately 650,000 acres of pastureland in this vegetative area. All of this acreage is located in the Gulf Prairies. The marsh will be discussed as it is used for rangeland. The two vegetative groups found in this vegetational area are clay and clay loam, and sandy loam.

The clay and clay loam group located on the coastal plain is the major interpretive group in the vegetative area. Dallisgrass, Louisiana S-1 clover, common bermudagrass, and pensacola bahiagrass are the most common pasture plants. Pastures are large and quite

often part of a rice farming operation. Wetness is the dominant hazard. The degree of control and the rate of removal will dictate management decisions. The cracking clayey soils inhibit the establishment and growth of grass seedlings. The average annual production for this group is approximately 300 pounds of beef per acre.

The sandy loam group is heavily dominated by coastal bermudagrass with pensacola bahiagrass, a secondary factor in forage production. In fact, some of the first plantings of coastal bermudagrass in Texas were in this area. A perched water table on some of the soils complicates establishment and management practices. Also the lack of a companion plant to furnish cool season grazing necessitates hay baling and storing which is a very expensive operation. Return from pastures in this group averages about 250 pounds of beef per acre annually.

Blackland Prairies Vegetational Area

There are about 20,000 acres of pastureland in this vegetative area. Only the clay and clay loam unit is used as pastureland. The most common pasture plant is coastal bermudagrass. The clay soil presents special problems during establishment of the grass. Operating units are small. The average annual production is 300 pounds of beef per acre.

Bottom Land

About 60,000 acres of the flood plain of the Trinity, San Jacinto, and Neches rivers are used as pastureland. The operating units will average over 500 acres which is slightly above the normal for this subarea. Flood control projects on all three rivers have enhanced forage production but inundation and excess water still disrupts the timing of management practices. Common bermudagrass, Dallisgrass, and pensacola bahiagrass which have a moderate to high degree of excess water tolerance are the most prevalent pasture grasses.

Problems and Needs

The conservation treatment needs for pastureland by land capability class and subclass are shown in Table 14. Seventy-seven percent of the land being used for pastureland needs some degree of conservation treatment. Conservation treatment of pastureland not only involves protection of the soil resource but also includes proper utilization of the plant resource for sustained forage production.

Treatment needs are divided into two general categories - improvement and reestablishment of vegetative cover. Various combinations of specific measures can be applied to achieve these objectives, according to the desires and needs of the landowner. The dominant hazard or problem is wetness with over one-third of the acreage

TABLE 14

Conservation Treatment Needs for Pastureland in the Upper Subarea, 1967*

Texas Coastal Basins

(Acres)

Land Capability Class and Sub Class	Total	Treatment Adequate	Treatment Infeasible	Change in Land Use	Total Needing Treatment	TREATMENT NEEDS						
						IMPROVE VEGETATIVE COVER				REESTABLISH VEGETATIVE COVER		
						Protection Only	Improvement Only	Brush Control and Improvement	Total	Reestablish-ment Only	Brush Control and Reestablishment	Total
I	194,981	74,345	0	0	120,636	11,070	83,344	984	95,398	25,238	0	25,238
IIE-IVE	238,523	52,129	514	0	185,880	21,746	97,844	6,859	126,449	22,816	36,615	59,431
IIW-IVW	565,673	95,509	711	0	469,453	65,082	329,735	2,856	397,673	57,935	13,845	71,780
IIS-IVS	113,832	34,174	0	0	79,658	17,005	46,633	1,840	65,478	8,809	5,371	14,180
VE-VIIIE	17,106	2,498	315	0	14,293	1,277	8,645	226	10,148	1,301	2,844	4,145
VW-VIIIW	76,491	9,456	354	0	66,681	5,731	34,522	3,118	43,371	5,716	17,594	23,310
VS-VIIIS	5,241	0	0	0	5,241	1,124	2,827	0	3,951	1,290	0	1,290
TOTALS	1,211,847	268,111	1,894	0	941,842	123,035	603,550	15,883	742,468	123,105	76,269	199,374

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

having an excess water problem. The erosion hazard is prevalent on slightly over 20,000 acres.

Of the 742,000 acres needing improvement, 123,000 need protection only. Sound management practices are needed to protect good strains of desirable grasses from overgrazing, fire, encroachment by undesirable plants, etc. Improvement only is needed on 603,000 acres. This involves increasing the density of desirable plants by overseeding, reducing grazing, or fertilization, or any combination of these. A small amount of pastureland needs brush eradication to enhance the effectiveness of other good management practices.

The need to reestablish vegetative cover exists on almost 200,000 acres. The need for revegetation is brought about by misuse of grazing lands, and drought. Any of these occurrences will drastically reduce the density and vigor of desirable productive grasses and pave the way for encroachment by undesirable plants. The control of competitive brush species is a prerequisite for successful revegetation.

Rangeland

In the Upper Subarea there are about 519,200 acres of land containing native grasses and forbs which are utilized for livestock production. Most of the rangeland (80 percent) is considered to be coastal

marshland with the remainder scattered throughout the coastal prairies.

Coastal Marsh

The marsh can be divided into two basic types for rangeland use. They are fresh marsh sites and salt marsh sites. The composition and quality of vegetative communities are governed by salinity and inundation frequency and depth of surface water. Salinity in the soil profile as well as fluctuation of the water table affects the kinds and amounts of plants growing on these areas.

The fresh marsh is usually located next to the uplands and generally the northern-most extent of the coastal marshes. Surface runoff and internal drainage are very slow to nonexistent. The water is relatively fresh and salinity rarely exceeds four percent (Allen, P.) (1.5 ppt) of Gulf strength (35 ppt). The climax of original vegetation of the site is dependent upon the prevailing depth and salinity of the water. In fresh marsh where the salinity is less than .2 percent and water depth ranges from minus two inches to plus four inches, maidencane is normally the dominant vegetation. When water depth ranges from minus two inches to plus six inches and water salinity is less than .5 percent, Jamaica sawgrass is dominant. As water depth increases from zero to 12 inches, giant cutgrass dominates the site. In the deeper fresh marshes where water depth

averages one to 12 inches and salinity is less than one percent, California bulrush is dominant. Cattails grow with the bulrush especially when water depths are greater than 10 inches. These plant communities intergrade where water tolerance and salinity levels overlap. The plant composition can be manipulated by varying water depth and salinity extremes through drainage and/or impoundment.

In climax condition the dominant plants make up about 50 to 60 percent of the total annual yield. Other plants found in the climax, but in lesser amounts, are switchgrass, longtom, bulltongue, alligatorweed, and cattails. Under continuous heavy grazing plants such as cockspur, smartweed, and alligatorweed increase or invade and become dominant. The total annual yield of this site in climax condition ranges from 9,000 to 14,000 pounds of air-dry vegetation per acre, depending on the specific plant community.

Salt marsh sites occur as level coastal marshland. Elevations range from slightly below mean sea level to slightly above. Surface runoff and internal drainage are very slow to lacking. Gulf storms and high tides flood most of the area. Salinity of the water ranges from about 4 percent (1.5 ppt) of Gulf strength to 45 percent (15.75).

The climax vegetation of this site is dependent upon the depth and salinity of the water. When water depth varies from about minus

two inches to plus 10 inches and salinity averages about 45 percent, smooth cordgrass dominates. When water depth averages minus two inches to plus four inches and salinity averages about 20 percent, the site is usually dominated by marshhay cordgrass and saltgrass. When salinity averages about nine percent, marshhay cordgrass and common reed are dominant.

In climax condition the dominant plants make up about 55 to 65 percent of the total annual yield. Other plants that are found in the climax are olney bulrush, saltmarsh bulrush, seashore paspalum, and Gulf cordgrass. With continuous heavy use plants such as needlegrass rush, sesbania, spiny aster, and annuals increase or invade.

The total annual yield of this site in climax condition ranges from 8,000 to 14,000 pounds of air-dry vegetation per acre, depending on depth of water and degree of salinity. The composition of vegetation can be manipulated by water control structures.

Problems and Needs

In addition to the inherent problems, there are many problems associated with man's development and use of the marsh. These problems are improper grazing management, salt water intrusion, and construction of drainage systems.

Conservation treatment needs by capability class and subclass for rangeland are shown in Table 15. Approximately 400,000 acres is marsh-rangeland and can be correlated with the acres showing a "w" which means wetness is the limiting constraint. Also Table 15 shows that 100,000 acres of the marsh-rangeland is not protected by essential conservation measures.

The marsh has been heavily grazed by cattle for the last 75 years with little thought given to quality and quantity of forage available. Proper grazing management is accomplished by grazing the marsh at an intensity that will provide for adequate residues on the soil surface for protection maintenance, and improvement. Where deterioration has occurred, it is necessary to defer grazing in order for preferred plants to regain their vigor and increase in density. Grazing distribution can be improved by the proper placement of watering facilities and the construction of "cattle walkways". Fresh water wells are the most dependable sources of fresh water although canals, ponds, and pits are used extensively. The number and location of coastal ridges in the marsh have profound influence on the distribution of livestock grazing. Normally cattle concentrate on or near these ridges and seldom graze into the marsh farther than about one-fourth mile. These ridges serve as a place of refuge for livestock as they forage into the marsh. As a result, grazing intensity is a function of the distance from these ridges. Compounding the situation is the uneven distribution of these ridges; therefore, to improve grazing "cattle walkways" are

TABLE 15

Conservation Treatment Needs for Rangeland in the Upper Subarea, 1967*

Texas Coastal Basins

(Acres)

Land Capability Class and Sub Class	Total	Treatment Adequate	Treatment Infeasible	Change in Land Use	Total Needing Treatment	TREATMENT NEEDS						
						IMPROVE VEGETATIVE COVER				REESTABLISH VEGETATIVE COVER		
						Protection Only	Improvement Only	Brush Control and Improvement	Total	Reestablish-ment Only	Brush Control and Reestablishment	Total
I	9,319	1,084	0	0	8,235	7,484	0	550	8,034	201	0	201
IIE-IVE	34,947	7,660	0	0	27,287	6,008	6,411	3,274	15,693	9,926	1,668	11,594
IIW-IVW	101,637	26,631	0	0	75,006	74,471	160	308	74,939	0	67	67
IIS-IVS	39,070	6,185	0	0	32,885	18,314	11,799	1,883	31,996	688	201	889
VE-VIIIE	4,991	870	0	0	3,519	704	854	489	2,047	1,205	267	1,472
VW-VIIIW	278,532	235,251	22,796	0	30,485	29,099	1,003	117	30,219	65	201	266
VS-VIIIS	51,295	26,314	1,360	0	23,621	23,621	0	0	23,621	0	0	0
TOTALS	519,189	293,995	24,156	0	201,038	159,701	20,227	6,621	186,549	12,085	2,404	14,489

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

constructed. Properly placed these earthen levees encourage more uniform grazing of the area.

Occasionally it becomes necessary to remove livestock from the marsh or confine them in a specific area to prevent overgrazing the marsh. Supplemental feeding is necessary in this situation. Supplemental feeding for livestock can be in form of pastures of introduced grasses, hay, or sack protein. Feed may be needed for brief periods during severe storms or longer periods when mosquitoes force cattle out of the marsh.

Burning is another management tool which is used extensively. Stockmen burn off the heavy cover of mature marsh vegetation to stimulate new succulent growth of plants and to increase the availability of forage. Depending on the management objective, burning should usually be carried out, about every third year, when water is high enough to protect the crown and roots of the plants. Extreme caution should be exercised because of an ill-timed burn can destroy valuable forage plants.

The construction and modification of drainage and water transportation systems has allowed water with a high salt content to intrude into the marsh. In drought periods, without a physical barrier, salt water moves up the drainage canals into the marsh. Strong south winds may also force seawater inland, causing it to spread over

marsh areas along the drains. As water evaporates, salt concentrations become greater, eventually destroying or seriously damaging vegetation. Salting kills less salt-tolerant plants and may cause mineral and organic soils to become unstable. This condition reduces productivity and creates a hazard for livestock. Gates in drainage ditches, barriers in larger streams and levees are needed to control the movement of water.

Forest Land

Forest occupies about 3.1 million acres. The Pineywoods vegetational area is a pine-hardwood forest dominated by pine on the upland and by hardwood on wetter lower elevations. Loblolly and shortleaf pine are principal softwood species with red oak, white oak, water oak, hickory, maple, and sweetgum being the most prevalent hardwoods. The understory is a complex plant association of grapevines, haw, American beautyberry, and coral berry.

Forest land is used primarily for timber production but secondary uses include grazing for livestock, wildlife habitat, and recreation. Land ownership can be divided into three categories - public, industry-related private, and non-industry-related private. The 180,000-acre Sam Houston National Forest and the 1,709-acre W. Goodrich Jones State Forest are the significant public holdings in forest land. The Big Thicket National Preserve of about 85,000

acres to be located in southeast Texas has been authorized for purchase. Seventy-one percent of the remaining forest land is controlled by corporations, most of which are involved in wood processing. Twenty-nine percent is classified as private ownership characterized by smaller holdings. The level of management on industry-related forest land is above the average.

Conservation treatment needs of counties located in the Upper Subarea are shown in Table 16. Treatment needs are shown for commercial and non-commercial forest land.

About one-third of the commercial forest is adequately treated, that is, conservation practices have been applied that will alleviate soil and water conservation problems. The establishment of timber stand on 627,000 acres is needed. This includes planting seedlings or using mechanical practices to facilitate natural regeneration. Slightly over 1.5 million acres are in need of timber stand improvement. This involves a myriad of practices such as thinning, culling, and pruning to shape the natural growth of desirable species. The amount of non-commercial forest is 111,000 acres. The conservation treatment is considered adequate on this type of forest land.

Other Land

Approximately 164,000 acres or 2.7 percent of the agricultural land area falls into this classification (Table 17). This is further

TABLE 16

Conservation Treatment Needs for Forest Land in the Upper Subarea, 1967 *

Texas Coastal Basins

(Acres)

COUNTY	COMMERCIAL FOREST				NON-COMMERCIAL FOREST			TOTAL FOREST			
	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Timber Stand Improve-ment	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Timber Stand Improve-ment
Brazoria**	0	0	0	0	91,666	91,666	0	91,666	91,666	0	0
Chambers	35,400	5,000	3,500	26,900	0	0	0	35,400	5,000	3,500	26,900
Fort Bend**	0	0	0	0	8,497	8,497	0	8,497	8,497	0	0
Galveston	0	0	0	0	5,073	5,073	0	5,073	5,073	0	0
Grimes**	34,535	3,453	5,181	25,901	6,578	6,578	0	41,113	10,031	5,181	25,901
Hardin	501,600	158,175	102,600	240,825	0	0	0	501,600	158,175	102,600	240,825
Harris	162,264	32,110	41,154	89,000	0	0	0	162,264	32,110	41,154	89,000
Jasper**	183,020	68,450	32,024	82,546	0	0	0	183,020	68,450	32,024	82,546
Jefferson	54,400	10,000	0	44,400	0	0	0	54,400	10,000	0	44,400
Liberty	453,600	96,475	40,800	316,325	0	0	0	453,600	96,475	40,800	316,325
Montgomery	497,169	140,160	133,824	223,185	0	0	0	497,169	140,160	133,824	223,185
Orange**	65,250	18,450	7,650	39,150	0	0	0	65,250	18,450	7,650	39,150
Polk**	347,910	106,873	88,034	153,003	0	0	0	347,910	106,873	88,034	153,003
San Jacinto**	128,465	48,675	33,040	46,750	0	0	0	128,465	48,675	33,040	46,750
Tyler**	348,790	103,640	84,196	160,954	0	0	0	348,790	103,640	84,196	160,954
Walker**	166,239	42,640	44,016	79,583	0	0	0	166,239	42,640	44,016	79,583
Waller**	23,868	7,033	11,577	5,258	0	0	0	23,868	7,033	11,577	5,258
TOTALS	3,002,510	841,134	627,596	1,533,780	111,814	111,814	0	3,114,324	952,948	627,596	1,533,780

*Treatment need is shown for the dominant or limiting constraint.
**Denotes Partial County in Subarea

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 17

Conservation Treatment Needs for Other Land in the Upper Subarea, 1967*

Texas Coastal Basins

(Acres)

County	Percent In Study Area	Percent In Subarea	IN FARMS			NOT IN FARMS			TOTAL - OTHER LAND		
			TOTAL	Need Treatment	Treatment Adequate	TOTAL	Need Treatment	Treatment Adequate	TOTAL	Need Treatment	Treatment Adequate
Brazoria	100	52	1253	520	733	2924	1040	1884	4177	1560	2617
Chambers	100	100	5461	3932	1529	15071	13542	1529	20532	17474	3058
Fort Bend	100	11	644	193	451	413	103	310	1057	296	761
Galveston	100	100	1522	700	822	21305	11000	10305	22827	11700	11127
Grimes	100	65	125	25	100	1005	101	904	1130	126	1004
Hardin	100	100	1248	0	1248	12476	0	12476	13724	0	13724
Harris	100	100	19566	15000	4566	14298	10000	4298	33864	25000	8864
Jasper	37	100	444	74	370	370	111	259	814	185	629
Jefferson	100	100	6129	2075	4054	25389	18673	6716	31518	20748	10770
Liberty	100	100	6799	300	6499	1275	277	998	8074	577	7497
Montgomery	100	100	953	318	635	12866	3216	9650	13819	3534	10285
Orange	45	100	675	315	360	3152	1575	1577	3827	1890	1937
Polk	62	100	310	186	124	310	155	155	620	341	279
San Jacinto	59	100	506	379	127	632	126	506	1138	505	633
Tyler	65	100	1082	780	302	270	195	75	1352	975	377
Walker	52	100	887	710	177	1775	1420	355	2662	2130	532
Waller	100	39	2355	655	1700	875	275	600	3230	930	2300
Totals			49959	26162	23797	114406	61809	525987	164365	87971	76394

*Treatment need is shown for the dominant or limiting constraint.

Source: U.S. Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

subdivided into land in farms and that not in farms. Examples of the "in farm" category would be feed lots, farm roads, farmsteads, ditch banks, fence rows, and other service areas. Examples of the land "not in farms" would be investment or speculative tracts and rural non-farm residences.

According to the Conservation Needs Inventory about 50 percent of the land needs some degree of conservation treatment.

Land Resource Development Potential

Land Availability and Suitability

The Upper Subarea has 5,997,327 acres which are classified as agricultural and forest land by the Conservation Needs Inventory (Table 18). Sixty-four percent of this land is suitable for continuous cultivation. Another 16 percent is marginal for cultivation. Only inventory land is considered potentially available for agricultural use.

This survey revealed 4,816,798 acres in Classes I through IV, which are the lands deemed suitable for row crops when managed within their capabilities. Class I land, which is suitable for continuous cultivation requiring only good cultural practices, accounts for 364,589 acres; 1,532,073 acres are Class II land which has certain limitations such as slope or erosion susceptibility that restricts

TABLE 18

Land Use by Capability Class, Upper Subarea

Texas Coastal Basins

Land Capability Class	Total Inventory Land Acres	Cropland Acres	Pastureland Acres	Rangeland Acres	Forest Land Acres	Other Acres	Distribution Percent
I	364589	50661	194981	9319	99634	9994	6.0
II	1532073	311948	366844	26524	787671	39086	25.5
III	1966229	561492	414949	145758	787044	56986	32.8
Subtotal	3862891	924101	976774	181601	1674349	106066	64.3
IV	953907	32322	136235	3372	775436	6542	16.2
Subtotal	953907	32322	136235	3372	775436	6542	16.2
V	487880	3537	39624	260183	172636	11900	8.2
VI	550395	5192	53155	6684	482817	2547	9.2
VII	104689	260	6059	54554	9086	34730	1.7
VIII	15376	0	0	12795	0	2581	0.4
Subtotal	1158340	8989	98838	334216	664539	51758	19.5
TOTAL	5975138	965412	1211847	519189	3114324	164366	100.0

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

the choice of plants and/or requires a moderate conservation treatment; 1,966,229 acres are Class III land which has severe limitations that reduce the choice of plants and/or require special conservation practices to protect the soil; 953,907 acres are Class IV land with soils having very severe limitations that restrict the choice of plants and/or require very careful management. Class IV soils are marginal for the production of cultivated crops.

There are 1,158,340 acres in Classes V through VIII that are not considered suitable for cultivation because of limitations that restrict their use. These limitations are impractical or infeasible to eliminate.

Cropland Suitable for Regular Cultivation

There is a total of 965,412 acres of land now supporting cultivated crops. Over 99 percent of these acres are on Class I through IV soils which are suitable for cultivation. Table 18 also reveals about four million acres of Class I through IV soils in other uses which could be cultivated with acceptable risk.

Potential for Shift from Grassland to Cropland

There are an estimated 1,158,375 acres of grassland (pasture and range) suited for continuous cultivation. Much of this acreage

could be put into cultivation. When treated according to its needs it could provide a perpetual source of farm related products. The balance would require the application of drainage or erosion control practices. Of the 1,158,375 acres, 204,300 acres are Class I; 393,368 acres are Class II; and 560,707 acres are Class III.

Potential for Shift of Forest Land to Cropland

There are about 100,000 acres of Class I forest land which could be converted to cropland. Another 787,671 acres of Class II forest land could be converted to cropland if practices are applied to control erosion. An additional 787,044 acres could be utilized as cropland but special excess water management and erosion control practices would be required. An aggregate of 1,674,349 acres of forest land would be suited for continuous cultivation. An additional 775,436 acres of Class IV forest land could be converted to cropland if special soil and water conservation practices are applied. The risks are greater and the choice of crops is limited. Extensive areas of forest land could be converted to cropland by clearing woody vegetation and installing drainage systems. Pressure for this type of change is localized and not widespread.

Potential for Shift from Cropland to Grazing Land and Forest Land

The use of land for crops has stabilized itself on Classes I, II, III, and IV land. The Conservation Needs Inventory revealed only

8,989 acres in cultivated crops on land which the soils are not suitable for cultivation. Therefore, there is little potential for a shift from cropland to grazing land and forest land because of unsuitable soils.

Other Land

The category which includes farmsteads, service areas, investment acreage, and fence rows accounts for 164,367 acres. Sixty-four percent of this land is classified as suitable for farming. Choice of land for this category depends primarily on location rather than on soil suitability.

Conclusion

Two factors indicate presently there is an ample supply of suitable soils for cropland to meet demand. Ninety-nine percent of the acreage now in crops is found on land that is Class I through IV. There are nearly three million acres of Class I through III agricultural and forest land which could be put into cultivation if the demand develops. Also there are nearly one million acres of Class IV agricultural and forest land which could be used to grow selected crops with very specific conservation management practices.

MIDDLE SUBAREA

Description

This subarea contains 10,027.5 square miles bounded on the east by the Brazos River Basin and on the west by the Guadalupe River Basin. It includes the following counties: Austin, Brazoria, Calhoun, Colorado, DeWitt, Fayette, Fort Bend, Goliad, Gonzales, Grimes, Jackson, Lavaca, Matagorda, Victoria, Waller, Washington, and Wharton (Plate 7).

A coastal or modified marine type climate prevails with temperatures fairly uniform although there are four distinct seasons - mild winters, hot summers, and warm springs and autumns. Annual rainfall amounts range from about 50 inches in Fort Bend County to 32 inches in DeWitt County. Mean annual temperatures average about 69 degrees F. throughout the subarea. The growing season 1/ generally is long enough to allow flexibility in crop selection and planting. The average annual frost free period is 300 days at Port Lavaca and 266 days at Pierce.

Gould describes three vegetational areas in this subarea - gulf prairies and marshes, post oak savannah, and blackland prairie. The Soil Conservation Service separated Bottom land from the vegetational areas because of its unique and fragile properties.

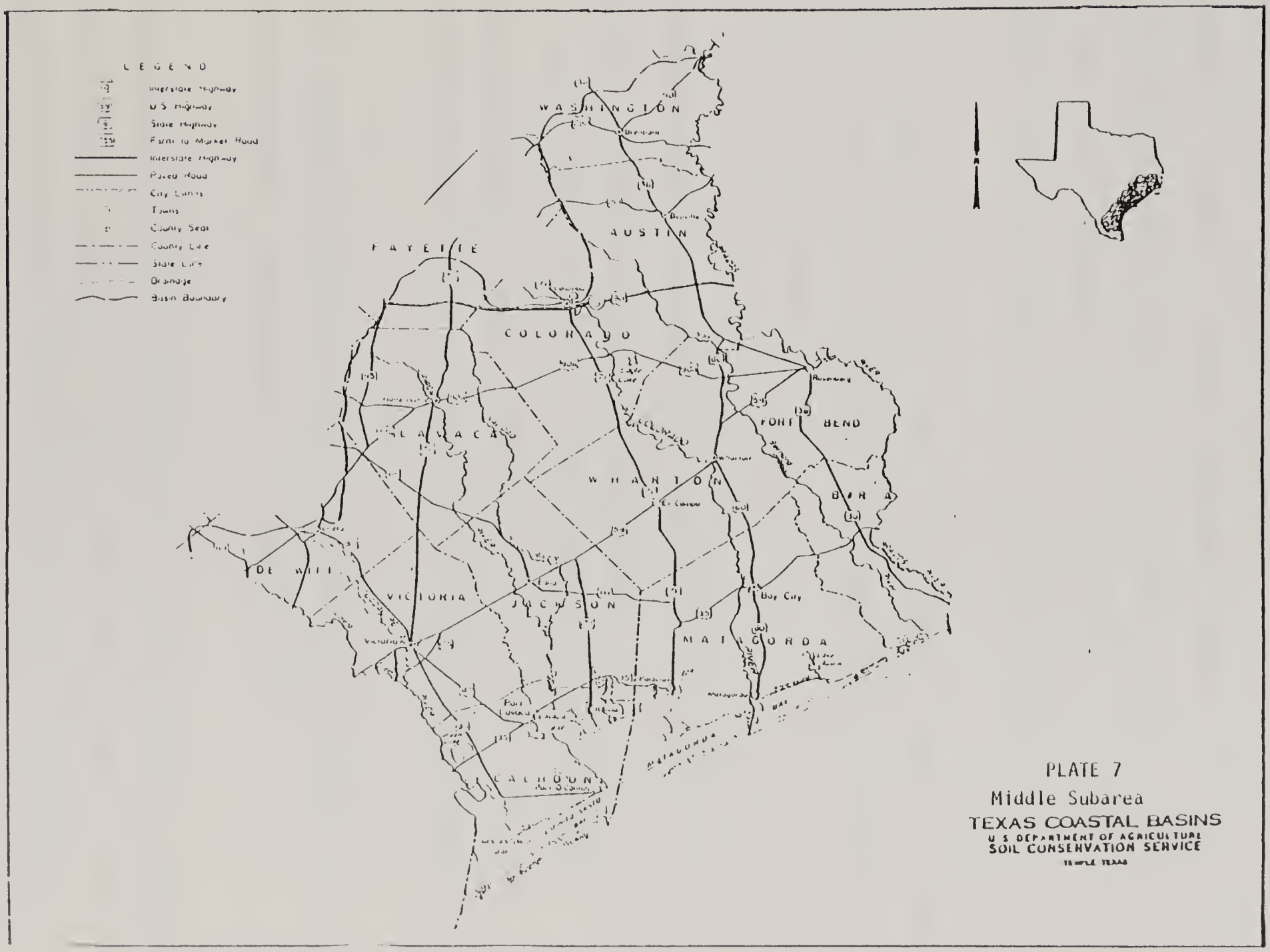
1/ Refers to the average number of days each year from the dates of last ground-level temperature of 32 degrees F. or less in the spring to the first such temperature in the fall or winter.

The gulf prairies and marshes cover over 50 percent of the subarea. The marshes are confined to a narrow strip along the coast. Inundation is principally by Gulf water and runoff from spring and fall rains. Vegetation consists principally of saltgrass, cordgrass, spikesedge, widgeongrass, and barnyardgrass. The Gulf Prairies vegetational area originally supported tall grasses or post oak savannah. Presently the principal vegetative species include bluestems, smutgrass, common bermudagrass, Panamerican balsamscale, huisache, macartney rose, and other subclimax species.

The post oak savannah is an open savannah grassland with post oak and blackjack oak providing approximately 20 percent canopy. Under present management the oak canopy has become more dense with an increase in yaupon, greenbriar, yankeeweed, bullnettle, brownseed paspalum, and other secondary species.

The Blackland Prairie vegetational area was, in its pristine condition, a true prairie with little bluestem dominating the ecological plant community. Man put most of the area to the plow but due to soil erosion and economic constraints it is no longer cultivated and has been converted to grassland. Present plant species include Texas wintergrass, buffalograss, threeawn, silver bluestem, and other perennial grasses. Broomweed, western ragweed, snow-on-the-prairie, and many other annual forbs also flourish.

There are five major stream systems in this subarea. They are the Brazos, Colorado, Lavaca, Navidad, and Guadalupe rivers. The



Source: United States Department of Agriculture, Soil Conservation Service

flood plains of these perennial streams support vigorous diverse plant communities. Major tree species are oak, elm, hackberry, cottonwood, ash, black willow, and pecan. Underbrush includes hawthorns, greenbriar, Alabama supplejack, grapes, and berry vines. The herbaceous plant community is dominated by sedges, Virginia wildrye, beaked panicum, and rustyseed paspalum. The most important forbs are lespedeza, tickclover, and snoutbean.

The 1970 population of this subarea was 322,449. There is a noted absence of metropolitan centers. Fort Bend County is probably the most populous county.

Economic diversity is prevalent in this subarea. Extensive oil, gravel, and sulphur deposits along with an aluminum plant as well as several petro-chemical complexes provide job opportunities. Crop and livestock income for 1973 was $398 million. This represents 47 percent of the total for the Texas Coastal Basins.

This subarea is adequately served by a network of highways and railroads which complement the intracoastal canal.

Recreation activities include hunting, fishing, swimming, boating, and driving for pleasure. Sandy beaches along the Gulf of Mexico provide opportunities for water-related sports. The subarea is refuted to have the goose hunting capital of the world at Eagle

Lake. Fishing for catfish, sunfish, and bass in the larger streams is a popular pastime.

Wildlife species most commonly found are deer, turkey, duck, goose, quail, javelina, and dove. Deer and quail densities are among the highest in the Texas Coastal Basins. Additional information is contained in the special report "Fish and Wildlife Resources, Texas Coastal Basins".

Soils

Lake Charles, Bernard, Edna, and other nearly level dark-colored to gray clayey and loamy soils with firm clay subsoils comprise about 2.5 million acres of this subarea. These soils have formed under tall bunch grasses in the limy sediments varying in clay and sand content. In the surface they are usually slightly acid but become more alkaline and calcareous with depth. They are high in montmorillinite clay giving them high shrink/swell potential. They have a high cation exchange capacity which imparts to the soils a capacity for holding organic matter, moisture, and plant nutrients.

Katy, Hockley, Telferner, and related series occupy about three million acres in the upper half of this subarea. These soils have formed in the sandy Lissie sediments. They are leached, more acid, and less fertile than the clayey soils toward the coast.

Also they contain less montmorillinite and more Kaolinite than the dark clayey soils. This, coupled with less organic matter, gives them a lower capacity for holding nutrients and moisture. Additional information may be found in the report "Soils of the Texas Coastal Basins".

The distribution of land by capability is shown in Figure 7. This classification is a practical grouping to reflect the natural limitations of the soils, the risk of damage in use, and their response to proper management. Cultivation, the most intensive use, is the baseline for comparing land capability classes. Classes I through III can generally be used for continuous cultivation with proper conservation measures to prevent deterioration of soil properties. Class IV land can be used for occasional cultivation with specific conservation measures to prevent degradation of soil properties. Soils in Classes V through VIII are generally defined as land limited in use - not generally suited for cultivation but are best suited for pasture, forest, wildlife habitat, recreation, or aesthetic purposes. Refer to pages 29 through 32 for a description of each capability class.

Land Use

There are 6,417,591 acres of land in this subarea. The Conservation Needs Inventory, 1967 separates this land into inventory and

non-inventory categories. Inventory land will be referred to in this report as agricultural land. This includes cropland, pasture-land, rangeland, forest land, and other land. Non-inventory land includes urban built-up and federal.

The agricultural land use distribution is illustrated in Figure 8. The grazing land and cropland are about evenly divided. The forest land consists of trees growing on land used primarily for grazing domestic livestock. This subarea contains almost half of the cropland in the Texas Coastal Basins.

Cropland

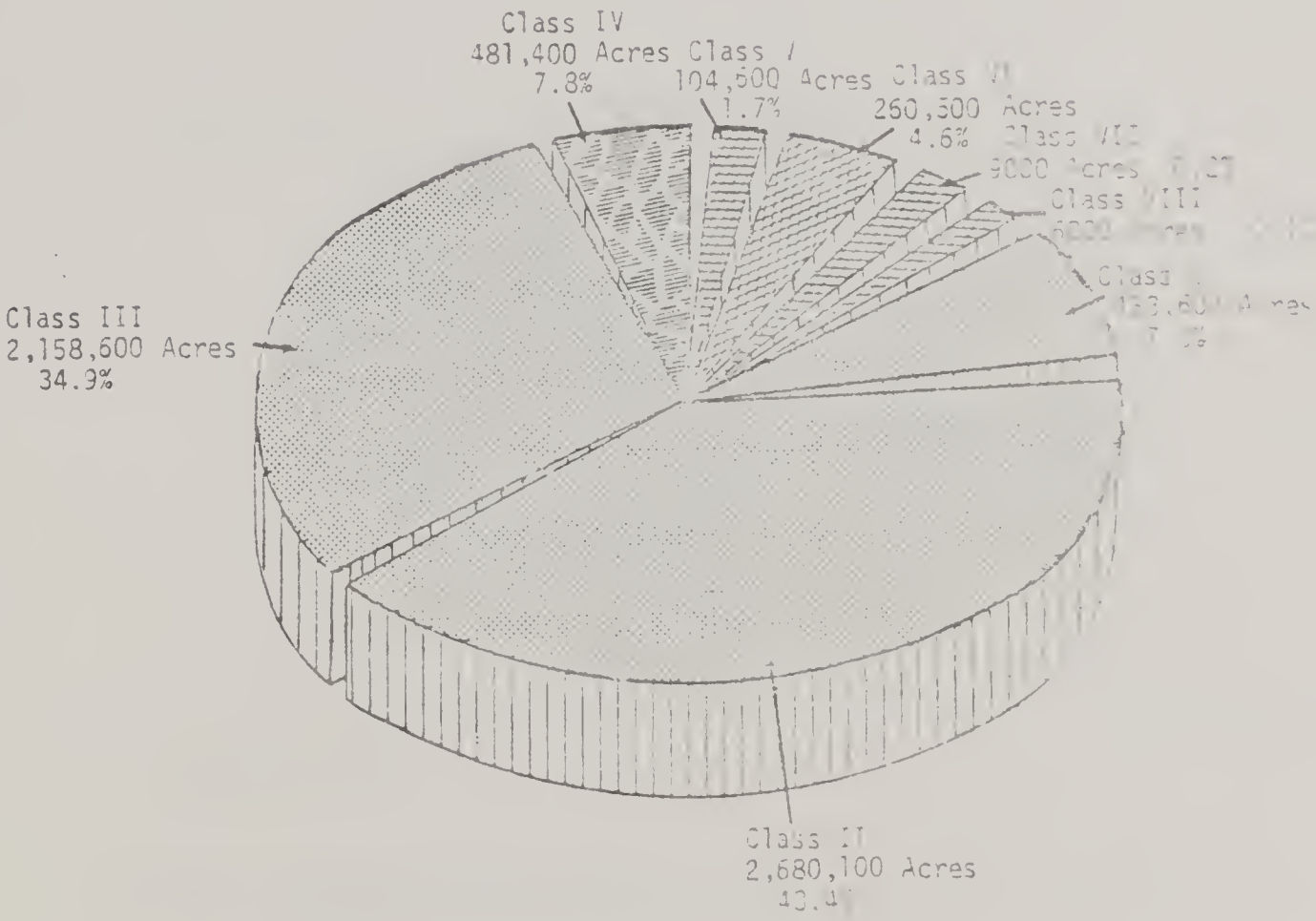
The Conservation Needs Inventory, 1970 revealed there are 2,186,900 acres of cropland. Non-irrigated acreage accounts for 1,665,700 acres while 521,200 acres are irrigated. Major cultivated crops are rice, grain sorghum, and cotton. Figure 9 shows major crops planted in 1973. Income from crops during this same year was $219 million.

Grain sorghum is the most extensive dry land crop. In 1973 400,000 acres were planted with smaller amounts of cotton, soybeans, and corn. This category includes idle cropland, cropland-pasture, and various miscellaneous crops.

FIGURE

Land Capability Classes for Agricultural Land, [illegible]

Middle Subarea, Texas Coastal Basins



SUITED FOR CONTINUOUS CULTIVATION, 5,292,300 ACRES

SUITED FOR LIMITED CULTIVATION, 481,400 ACRES

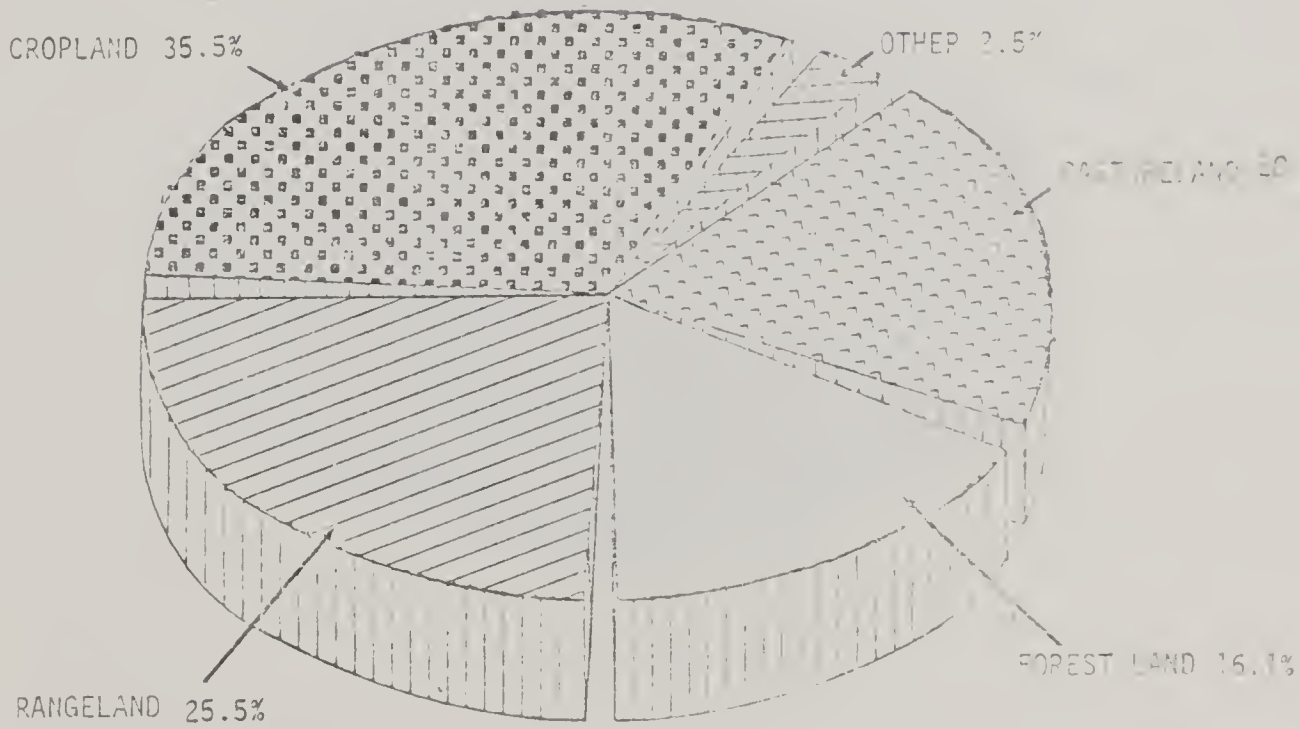
NOT SUITED FOR CULTIVATION, 405,800 ACRES

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

FIGURE 3

Agricultural Land Use, 1967

Middle Subarea, Texas Coastal Basins

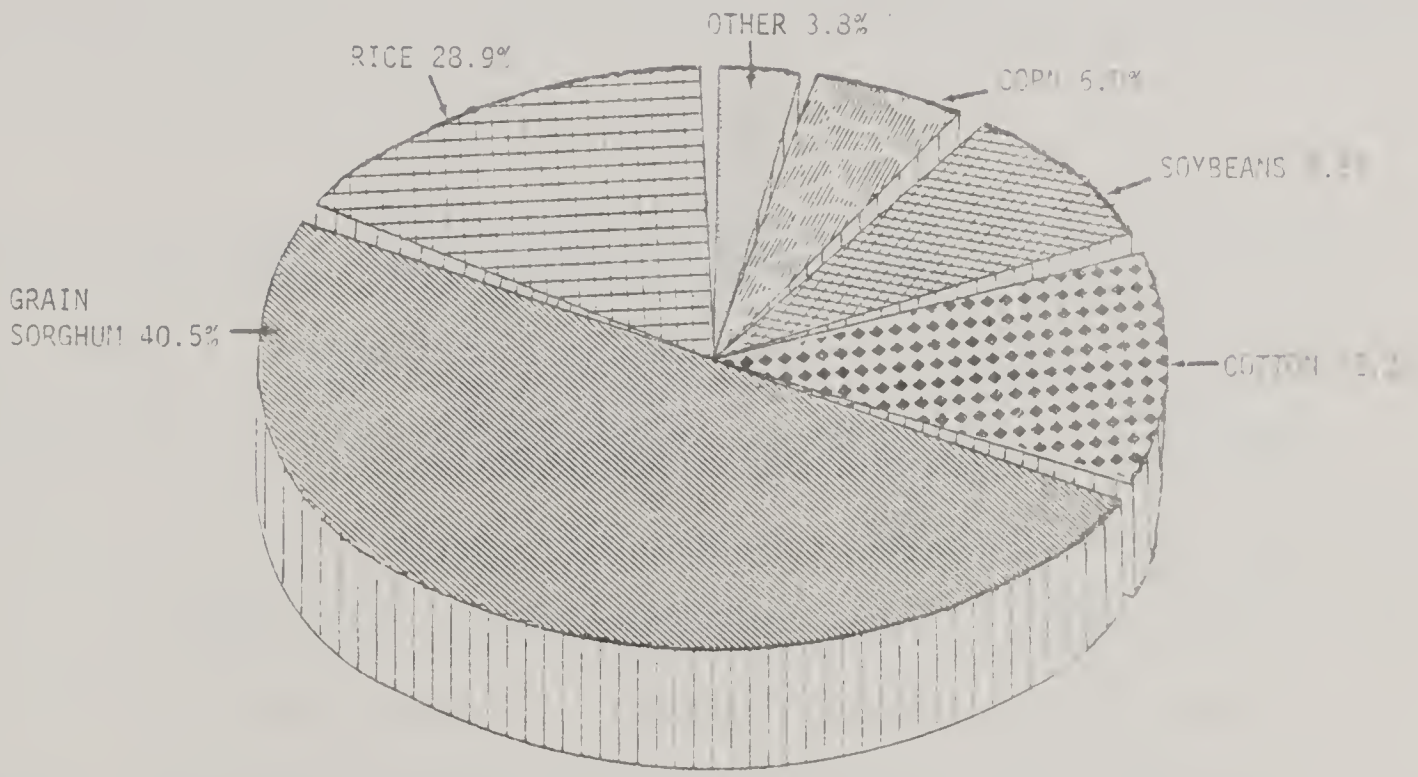


Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

FIGURE 9

Major Crops Planted, Middle Subarea

Texas Coastal Basins



1/ From 1973 Texas County Statistics

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

Irrigated cropland is land on which irrigation water has been applied by an adapted irrigation system at least two years out of the past five. Rice, the principal irrigated crop, was planted on 291,978 acres in 1973. Rice is normally grown on the same land every other year or every third year. This rotation scheme requires a land base for rice production somewhat larger than the allotted acreage. According to the "Inventory of Texas Irrigation" by the Soil Conservation Service in 1974 about 61 percent of the crop irrigation was from underground aquifers.

Table 19 displays conservation treatment needs by capability class and subclass. Capability grouping shows in a general way the suitability of soils for most kinds of field crops. The Roman numerals indicate progressively greater limitations on the use of the soil. The subclasses are designated by adding a small "e", "w", "s", or "c" to the Roman numeral. The small letter denotes that the primary limitation is (e) erosion, (w) wetness, (s) soils, or (c) climate.

According to Table 19 almost 1,200,000 acres of dry cropland need conservation treatment. There are slightly more than 500,000 acres of dry cropland where drainage is the limiting use factor. Drainage may also be a secondary factor on other acres. Agricultural drainage costs are variable depending upon the soil type and whether cost of an adequate outlet ditch is added to on-farm drainage cost. Nearly one half million acres show a need for high

TABLE 19

Conservation Treatment Needs for Cropland in the Middle Subarea, 1967*

Texas Coastal Basins

Land Capability Class and Sub-Class	Total Cropland	Adequately Treated	Needing Treatment	NON IRRIGATED CROPLAND							IRRIGATED CROPLAND			
				Residue and Annual Cover	Sod in Rotation	Contour Only	Strip Cropping Terracing Diversions	Permanent Cover	Drainage	Total	Cultural Management Practices Only	Improved Systems	Water Management	Total
I	170,960	60,129	110,831	62,631	280	0	0	4,969	16,910	84,790	67	25,750	224	26,041
IIE	142,548	58,671	83,877	48,336	6,814	916	14,219	10,948	1,585	82,818	0	632	427	1,059
IIIE	167,594	54,428	113,166	38,491	9,951	766	31,449	27,808	763	109,228	0	3,938	0	3,938
IVE	79,072	11,745	67,327	8,898	2,713	236	8,807	21,196	0	41,850	5,453	11,848	8,176	25,477
VIE	4,941	937	4,004	1,303	507	0	443	1,333	0	3,586	0	418	0	418
IIW	96,851	18,441	78,410	4,128	0	0	0	813	15,245	20,186	8,946	41,102	8,176	58,224
IIIW	286,321	39,432	246,889	15,277	213	221	426	0	131,043	147,180	4,986	94,723	0	99,709
IVW	48,400	2,921	45,479	0	0	0	0	1,302	20,601	21,903	5,202	17,296	1,078	23,576
VW	13,427	3,833	9,594	1,617	1,800	126	0	5,251	380	9,174	0	420	0	420
VIW	1,950	372	1,578	1,578	0	0	0	0	0	1,578	0	0	0	0
VIIW	835	0	835	0	0	0	0	0	0	0	0	835	0	835
IIS	986,397	242,574	743,823	254,817	5,680	821	4,635	20,202	279,960	566,115	21,095	156,613	0	177,708
IIIS	175,379	46,672	128,707	18,800	9,184	0	2,304	12,226	41,528	84,042	2,854	38,823	2,988	44,665
IVS	8,286	459	7,827	640	193	0	0	0	5,637	6,470	0	1,357	0	1,357
VIS	3,853	0	3,853	2,238	0	0	0	1,020	0	3,258	193	402	0	595
IIC	93	0	93	93	0	0	0	0	0	93	0	0	0	0
TOTAL	2,186,907	540,614	1,646,293	458,847	37,335	3,086	62,283	107,068	513,652	1,182,271	48,796	394,157	21,069	464,022

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

residue-producing crops which will provide residues to protect the soil and improve the organic matter content.

Conservation treatment needs for irrigated cropland center around 394,000 acres which are served by inadequate irrigation systems. An adequate system is one that delivers the water with a minimum loss. This system includes adequate drainage measures.

Pastureland

There are approximately 1,258,000 acres of pastureland in the Middle Subarea. Pasture of introduced grasses are created as a result of cultivated land being put into grass and land with brush being cleared by mechanical means. Principal grasses established for pastureland are coastal bermudagrass, gordo bluestem, King Ranch bluestem, Angleton bluestem, and bahiagrass.

Gould (1) described three vegetational areas in this hydrologic unit. They are Gulf Prairies, Post Oak Savannah, and Blackland Prairie. The Bottom land within these vegetational areas is discussed separately because of its unique properties and importance to the vegetative scheme. Pastureland occurs in each of these areas.

Gulf Prairies Vegetational Area

Pastureland accounts for about 370,000 acres primarily in the clay and clay loam group and the sandy and sandy loam group. The clay

and clay loam group is cultivated but interspersed as part of the farming operation, or as a separate entity are pastures of various introduced bluestem grasses and coastal bermudagrass. Assuming average conditions these pastures will produce three to seven AUM of grazing per acre. On sandy loam soils coastal bermudagrass is planted almost exclusively. This type of pasture will produce four to eight AUM of grazing per acre under normal growing conditions and under moderate levels of fertilization.

The trend in this vegetational area will continue to be to convert land from cropland to pastureland. However, the conversion will not be as rapid as other vegetational areas as long as the profit margin for grain sorghum and rice remains attractive.

Post Oak Savannah Vegetational Area

Introduced grasses have been established on about 325,000 acres. The land is cleared of woody vegetation then established to grasses capable of increased forage production. This is usually a choice of the land-owner brought about by rising taxes and mediocre return from an existing post oak plant community. Coastal bermudagrass is often established since it is well adopted and yields good quality forage when fertilized and managed properly. Due to the increased production cost such as fertilizer and fuel, the current trend is to reestablish land converted from a woody plant community to grasses that require no fertilization in order to maintain vigor and produce quality forage for domestic livestock consumption.

Blackland Prairie Vegetational Area

There are approximately 560,000 acres of pastureland in this vegetational area. This clay and clay loam group in a rolling landscape was put into cultivation by early settlers. Due to the rolling topography and the soil's susceptibility to erosion from water the productive capacity was reduced to a marginal level. This factor along with the beginning of a change from an agrarian society to an industrial society resulted in much of this cultivated land being converted to pastureland. Generally livestock operating units average 200 to 400 acres, are specialized, and contain a high degree of improvement. Absentee ownership is prevalent especially along major highways leading from urban centers.

Coastal bermudagrass is currently the pasture grass most often established with a lesser acreage being planted to various native and introduced bluestems. Production of forage varies with the level of management but under average conditions, coastal bermudagrass pastures will produce between three and six AUM of grazing per acre per year. This is the equivalent of 100-300 pounds of beef per acre from a cow-calf operation which produces a calf at weaning that weighs 500 pounds.

Bottom Land

There are approximately 171,200 acres of pastureland located in the Bottom land. Bermudagrasses are by far the most popular pasture

TABLE 20

Conservation Treatment Needs for Pastureland in the Middle Subarea, 1967*

Texas Coastal Basins

Land Capability Class and Sub Class	Total	Treatment Adequate	Treatment Infeasible	Change in Land Use	Total Needing Treatment	TREATMENT NEEDS						
						IMPROVE VEGETATIVE COVER				REESTABLISH VEGETATIVE COVER		
						Protection Only	Improvement Only	Brush Control and Improvement	Total	Reestablish-ment Only	Brush Control and Reestablishment	Total
I	147,498	57,986	0	0	89,512	45,177	31,211	9,104	85,492	3,847	173	4,020
IIE-IVE	443,415	105,574	628	220	336,993	120,570	97,487	39,867	257,924	51,626	27,443	79,069
IIW-IVW	146,761	40,427	0	0	106,334	25,602	64,958	5,623	96,183	3,353	6,798	10,151
IIS-IVS	441,606	80,418	2,786	0	358,402	143,221	146,254	25,786	315,261	25,361	17,780	43,141
IIC-IVC	303	0	0	0	303	303	0	0	303	0	0	0
VE-VIIIE	29,073	4,092	0	0	24,981	7,192	11,487	1,755	20,434	3,596	951	4,547
VW-VIIIW	47,603	17,372	220	0	30,011	10,045	8,306	7,325	25,676	1,992	2,343	4,335
VS-VIIIS	1,818	373	0	0	1,445	97	363	305	765	421	259	680
TOTALS	1,258,077	306,242	3,634	220	947,981	352,207	360,066	89,765	802,038	90,196	55,747	145,943

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

grasses. Both coastal and common are popular. In lesser amounts one finds improved bluestems, Dallis, bahia, and clovers being planted. Although yields vary greatly with management, the average yield of coastal bermudagrass is three to six AUM of grazing per acre per year.

Problems and Needs

Because of the high average age of the farmers and frequency of absentee ownership the trend of converting cropland to pastureland will continue. Major problems experienced by livestock producers on pastureland deal primarily with economics and management. Producers apathy concerning benefit of proper grazing management frequently presents resource conservation related problems. Improper grazing management reduces stand productivity and vigor which invites encroachment by undesirable plants. Weed control becomes a maintenance cost. Coastal bermudagrass normally requires annual applications of fertilizer to produce good quality forage. This is a costly input with a high degree of risk. The unavailability of an adaptable cool season perennial plant requires livestock producers to plant winter annuals or put up hay. Either source of winter forage is expensive and often unreliable.

The conservation treatment needs for pastureland in 1970 are shown by capability class and subclass in Table 20. This conservation treatment involves both the protection of the soil and proper utilization of the plant resource for sustained forage production. Nearly

one million acres of pastureland have a soil and water conservation problem which needs treatment. This treatment is divided into two categories - improvement or reestablishment of the vegetative cover. Most of the pastureland has a sufficient seed source but management techniques are necessary to increase plant density and protect it from overgrazing and encroachment by undesirable plants. About 800,000 acres fall into this category. Reestablishment is needed on approximately 145,000 acres.

Rangeland

There are just over 1.5 million acres of native grasses and forbs which are used for producing livestock. This rangeland occurs in three vegetational areas (Gould) (Plate 5). They are the Gulf Prairies, Post Oak Savannah, and Texas Blackland Prairie. The Soil Conservation Service discussed Bottom land separately because of its unique characteristics.

Gulf Prairies Vegetational Area

The original plant community is a true prairie. The rangeland in this vegetational area was subdivided into a clayey vegetative group, a sandy loam group, and a coastal sandy vegetative group (Plate 6).

Clayey Vegetative Group. The clayey vegetative group, which includes clay and clay loam soils, accounts for about 209,000 acres. The original plant community which is composed of 95 percent grasses and five percent forbs is a true prairie. Little bluestem is the dominant plant in this community with Indiangrass being a strong subdominant. Other grasses include switchgrass, eastern gamagrass, big bluestem, brownseed paspalum, and Texas wintergrass. The common forbs are sensitivebriar, yellow neptunia, and bundleflower.

The original plant community has been altered in most instances by improper grazing management coupled with land use changes resulting from overriding economic constraints. Much of the original flora has been replaced by less desirable vegetation which includes Texas wintergrass, brownseed paspalum, meadow dropseed, broomsedge bluestem, and other invading or increasing plants. Woody plants which either invade or increase are huisache, baccharis, macartney rose, and sesbania. Where woody plants are found, they are in densities which reduce herbaceous plants production. Presently this vegetative group will support an annual animal unit of grazing on 10 to 30 acres depending upon moisture availability, management, and existing vegetative plant communities.

The soils of this vegetative group are very suitable for cultivation; therefore, the trend is to convert rangeland to cropland. Most of the rangeland in this vegetative group exists because of institutional constraints.

Sandy Loam Vegetative Group. The sandy loam vegetative group is found on about 125,000 acres underlain by soils of the Edna, Katy, and Telferner series. This delineation is an interface between the sandy Post Oak Savannah and the sandy loam groups on the coast prairies. Little bluestem dominates the climax plant community with Indiangrass, crinkleawn, and big bluestem being strong subdominants. Florida paspalum, brownseed paspalum, fall witchgrass, and low panicums are significant components of the original plant community.

Forbs, which make up about five percent of the total composition of the original plant community, and include such plants as gayfeather sensitivebriar, bundleflower, and yellow neptunia.

Improper grazing management coupled with drought have resulted in many of the indigenous plants to become a minor component of the present plant community. Panamerican balsamscale, brownseed paspalum, knotroot bristlegrass, and smutgrass have replaced much of the original flora and are now major components of the plant community. Woody plants which have increased or invaded the present plant community are live oak, huisache, macartney rose, and sesbania.

The sandy loam vegetative group currently produces considerably less than its potential due to the aforenoted plant composition changes.

Soils in this vegetative group have a clay subsoil and occur in a nearly level landscape which makes them very suitable for rice pro-

duction. The trend is to convert rangeland to cropland as the demand develops. However, considerable marginal cropland is currently being converted or reestablished to grassland.

Coastal Sandy Vegetative Group. The coastal sandy vegetative group (Plate 5) occurs on nearly level to undulating or duned coastal terraces which may be interspersed with depressions. Principal soil series are Galveston and Mustang. The climax plant community of this group is varied depending upon topography and elevation. The sandy ridges and mounds are dominated by seacoast bluestem. Subdominants are switchgrass and gulfdune paspalum. Switchgrass is the dominant plant in the swales. Longtom and marshhay cordgrass also grow in the depressions. Principal forbs are sensitivebriar and bundleflower.

The present plant community is composed of gulfdune paspalum, low panicum, marshhay cordgrass, switchgrass, longtom, and little bluestem. On Matagorda Island gulfdune paspalum and seaoats are most prevalent. Generally, in its present condition the deep sandy vegetative group will produce from 2,000 to 5,000 pounds of air dry vegetation per acre annually depending on ecological status and growing conditions.

Post Oak Savannah Vegetational Area

The land used as rangeland in this vegetational area is further subdivided into a sandy vegetative group and a sandy loam vegetative group.

Sandy Vegetative Group. There are approximately 460,100 acres of rangeland in the sandy vegetative group. The major soil series are Stratton and Crockett. The original vegetation is an open savannah grassland with post oak and blackjack oak trees shading about 20 to 25 percent of the ground. Little bluestem is the dominant vegetation. It usually makes up about 60 percent of the total annual yield. Indiangrass is a strong subdominant as it accounts for about 10 percent of the total yield. Other important grasses found in the original vegetation include switchgrass, crinkleawn, purpletop tridens, brownseed paspalum, tall dropseed, and low panicums. Forbs make up about five percent of the original plant community. The more important forbs include partridgepea, wildbean, snoutbean, sensitivebriar, and lespedezas. Woody plants contribute about 15 percent to the total yield or composition. The most prevalent woody plants are post oak and blackjack oak trees. They dot the landscape in a park-like appearance. Other woody vegetation found in lesser amounts include greenbriar, yaupon, and American beautyberry. The original plant community produces approximately 5,000 pounds of air dry vegetation in favorable years. Approximately 600 pounds of the total yield is produced by woody vegetation.

Exclusion of fire, unfavorable weather conditions and improper grazing techniques have altered the original plant community. The present plant community is characterized by dense thickets of oak, yaupon, and greenbriar. The understory vegetation is directly related to the canopy of the overstory. The canopy densities are generally in excess of 50 percent. Under heavy canopies, nearly all grasses and forbs are shaded out. When sunlight does penetrate the canopy, grasses such as red lovegrass, brownseed paspalum, broomsedge bluestem, and annual grasses are common.

Weeds are very prevalent on this vegetative group in a deteriorated condition. Yankeeweed, bullnettle, and beebalm are common weeds. In the present condition, it generally requires in excess of 20 acres to adequately support one animal unit of grazing yearlong. The vegetative group generally produces less than 2,500 pounds of air dry vegetation per acre in the present condition during normal growing conditions.

The trend has been to convert rangeland to pastureland any time mechanical brush control is carried out. Coastal bermudagrass or other improved pasture grasses are generally established.

Sandy Loam Vegetative Group. The sandy loam vegetative group is found on about 210,000 acres characterized by soils of the Stratton,

Tabor, and Crockett series. This delineation (Plate 6) is an area of interface between the sandy vegetative group in the Post Oak Savannah vegetational area and the clay loam vegetative group in the Gulf Prairies vegetational area. Little bluestem dominates the climax plant community with Indiangrass, crinkleawn, and big bluestem being strong subdominants. Florida paspalum, brownseed paspalum, fall witchgrass, and low panicums are significant components of the original plant community. Forbs, which make up about five percent of the total composition of the original plant community, are gayfeather sensitivebriar, bundleflower, and yellow neptunia.

Improper grazing management, exclusion of fire, and drought have resulted in little bluestem becoming a minor component of the present plant community. Panamerican balsamscale, brownseed paspalum, knotroot bristlegrass, and smutgrass are major components of the community. Woody plants which have increased or invaded the present plant community are live oak, huisache, macartney rose, and sesbania. Plant communities in the sandy loam vegetative group generally produce less than 3,000 pounds of air dry forage per acre annually under normal growing conditions.

Blackland Prairies Vegetational Area

The clayey vegetative group is the only vegetative group found in this vegetational area. This group consists of approximately

15,600 acres in rangeland. This is a small vegetative group as most land has been converted to either cropland or more recently pastureland. The major soil series found in this vegetative group are Heiden, Klump, and Engle. In its pristine condition the original plant community is a true prairie. Grasses comprise 85 percent of the total composition or yield of the plant community. Little bluestem dominates the original plant community making up 50 to 70 percent of the total yield. Indiangrass and big bluestem are strong subdominants and can contribute up to 25 percent of the total composition. Other grasses found in lesser amounts include eastern gamagrass, switchgrass, Virginia wildrye, sideoats grama, Texas wintergrass, tall dropseed, and many others. Forbs contribute 10 percent of the total composition of the original plant community. A few of the more important forbs include maximillian sunflower, englemanndaisy, gayfeather, bundleflower, and prairieclover. Woody plants only account for five percent of the total yield or composition of the original plant community. These trees are generally live oak, elm, and hackberry. They are usually located in the draws or in an occasional mott on the landscape. Post oak trees are sometimes found in a savannah type situation where this vegetation type merges with the sandy vegetative type. The original plant community will produce 3,000 to 7,000 pounds of air dry forage per acre depending on growing conditions.

In the present condition less than 35 percent of the original plant community is generally found on most areas. The original plant community has been altered by factors such as livestock grazing coupled with drought and early attempts at cultivation. The present plant community is characterized by a dominance of Texas wintergrass and buffalograss. Silver bluestem, sideoats grama, and dropseeds are found in lesser amounts. Texas grama, threeawn, and annual forbs invade the plant community. Deteriorated pastures often have an abundance of broomweed, western ragweed, snow-on-the-prairie, and many other annual weeds. Woody plants such as mesquite, osage orange, and winged elm may invade or increase in the plant community. In the present condition much of this vegetation type is producing less than 2,000 pounds of air dry vegetation per acre.

The past trend has been to convert rangeland to cropland. Present trend include abandoned cropland fields being planted to improve pasture grasses. Coastal bermudagrass and other warm season perennial grasses are usually established on these lands.

Bottom Land

The use of the bottom land for rangeland accounts for about 62,600 acres. The original plant community is a savannah grassland. Overstory plants such as oak, elm, hackberry, cottonwood, ash, black willow, and pecan form about a 30 percent canopy. Understory plants are

hawthorn, greenbriar, Alabama supplejack, grapes, and berry vines. The herbaceous plant community in shaded areas is dominated by sedges, Virginia wildrye, beaked panicum, and rustyseed paspalum. As the canopy becomes more open switchgrass, little bluestem, low panicums, and eastern gamagrass become more numerous. Important forbs are lespedezas, tickclover, and snoutbean. The original plant community produces 5,000 to 9,000 pounds of air dry forage per acre annually.

Livestock grazing coupled with extreme moisture conditions have resulted in the alteration of the original plant community. In many instances woody plants remain only as riparian vegetation. Dense canopies of trees and shrubs limit the herbaceous community to the more shade tolerant plants. Where the canopy is more open broomsedge bluestem, smutgrass, carpetgrass, brownseed paspalum, and a variety of other plants compete for nutrients. This present plant community generally produces less than 3,500 pounds of air dry vegetation per acre annually. It takes over 18 acres to safely support an animal unit of grazing yearlong.

The trend is to convert this area to improved pastures of Dallisgrass, bahiagrass, coastal bermudagrass, or common bermudagrass.

Problems and Needs

The conservation treatment needs for rangeland are shown on Table 21. Seventy-six percent of the rangeland needs some degree of conservation treatment. Treatment needs are divided into two general categories - improvement and reestablishment of the vegetative cover. Various combinations of specific measures can be used to protect the soil and utilize the plant resource for sustained forage production. Improvement generally is centered around good management practices. Most of the rangeland needing treatment falls in this category although control of woody plants (brush) is necessary on about a half million acres before good management can become effective.

Forest Land

The Conservation Needs Inventory of 1967 classified nearly one million acres as forest land in the Middle Subarea (Table 22). Two categories were identified - commercial and non-commercial.

The commercial forest covers 141,000 acres and is generally confirmed to bottom land hardwoods. Species include oak, elm, hackberry, cottonwood, and ash. Underbrush consists of Alabama supplejack, grapes, and berry vines. The herbaceous plant community is dominated by sedges, Virginia wildrye, beaked panicum, and rustyseed paspalum.

TABLE 21

Conservation Treatment Needs for Rangeland in the Middle Subarea, 1967*

Texas Coastal Basins

Land Capability Class and Sub Class	Total	Treatment Adequate	Treatment Infeasible	Change in Land Use	Total Needing Treatment	TREATMENT NEEDS						
						IMPROVE VEGETATIVE COVER				REESTABLISH VEGETATIVE COVER		
						Protection Only	Improvement Only	Brush Control and Improvement	Total	Reestablish-ment Only	Brush Control and Reestablishment	Total
I	88,481	25,605	0	0	62,876	13,754	7,093	39,366	60,213	1,880	783	2,663
IIE-IVE	400,780	63,104	0	0	337,676	62,209	40,156	140,768	243,133	33,826	60,717	94,543
IIW-IVW	268,231	60,042	230	0	207,959	82,399	51,139	64,219	197,757	4,282	5,920	10,202
IIS-IVS	607,717	145,400	1,378	0	460,939	82,643	119,405	208,026	410,074	26,115	24,750	50,865
IIC-IVC	484	0	0	0	484	0	0	0	0	387	97	484
VE-VIIIE	70,116	5,343	8,205	0	56,568	15,353	10,926	22,331	48,610	3,687	4,271	7,958
VW-VIIIW	89,581	44,109	2,219	0	43,253	15,082	3,262	22,568	40,912	1,054	1,287	2,341
VS-VIIIS	43,452	18,184	0	0	25,268	23,334	131	1,318	24,783	485	0	485
TOTALS	1,568,842	361,787	12,032	0	1,195,023	294,774	232,112	498,596	1,025,482	71,716	97,825	169,541

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 22

Conservation Treatment Needs for Forest Land in the Middle Subarea, 1967*

Texas Coastal Basins

County	COMMERCIAL FOREST				NON-COMMERCIAL FOREST			TOTAL FOREST			
	Total	Treatment Adequate	Establishment and Reinforcement	Timber Stand Improvement	Total	Treatment Adequate	Establishment and Reinforcement	Total	Treatment Adequate	Establishment and Reinforcement	Timber Stand Improvement
Austin**	51,330	0	16,574	34,806	0	0	0	51,380	0	16,574	34,806
Brazoria**	0	0	0	0	84,623	84,623	0	84,623	84,623	0	0
Calhoun	0	0	0	0	0	0	0	0	0	0	0
Colorado**	5,624	0	1,954	3,670	140,348	140,348	0	145,972	140,348	1,954	3,670
DeWitt**	0	0	0	0	59,827	59,827	0	59,827	59,827	0	0
Fayette**	5,640	200	2,240	3,200	24,440	24,440	0	30,080	24,640	2,240	3,200
Fort Bend**	0	0	0	0	68,740	68,746	0	68,746	68,746	0	0
Goliad**	0	0	0	0	43,698	43,698	0	43,698	43,698	0	0
Gonzales**	462	462	0	0	1,386	1,386	0	1,848	1,848	0	0
Grimes**	8,597	5,807	2,790	0	23,542	23,542	0	32,139	29,349	2,790	0
Jackson	0	0	0	0	67,489	67,489	0	67,489	67,489	0	0
Lavaca**	12,701	12,701	0	0	147,184	147,184	0	159,885	159,885	0	0
Matagorda	0	0	0	0	96,841	96,841	0	96,841	96,841	0	0
Victoria**	0	0	0	0	5,740	5,740	0	5,740	5,740	0	0
Waller**	4,332	4,332	0	0	33,000	33,000	0	37,332	37,332	0	0
Washington**	0	0	0	0	26,040	26,040	0	26,040	26,040	0	0
Wharton	0	0	0	0	76,804	76,804	0	76,804	76,804	0	0
TOTALS	88,736	23,502	23,558	41,676	899,708	899,708	0	988,444	923,210	23,558	41,676

*Treatment need is shown for the dominant or limiting constraint.

**Denotes partial county in subarea

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

The non-commercial forest area is the post oak-blackjack oak complex which is usually managed as grazing land or for the production of wildlife. The underbrush species are yaupon, American beautyberry, and greenbriar. Brownseed paspalum, broomsedge bluestem, and red lovegrass make up the grass community. Yankeeweed and bullnettle are common weeds.

The needs for treatment to sustain and utilize the resource include reinforcing the existing stand through establishment and improvement practices. Timber stand improvement is needed on about one half of the commercial forest. The present treatment is adequate on 92 percent of the non-commercial forest.

There is a very high demand for land in the post oak forest. Plant and animal diversity as well as a gently rolling topography give the area a high aesthetic appeal. Absentee landowners who are not greatly concerned with the income producing capacity of the land buy tracts for week-end homes and small ranches. This factor probably has been instrumental in preserving this ecotype.

Other Land

Approximately 152,000 acres or about 2.4 percent of the agricultural land falls into this classification (Table 23). Examples of the "in farm" category would be feed lots, farm roads, farm-

TABLE 23

Conservation Treatment Needs for Other Land in the Middle Subarea, 1967*

Texas Coastal Basins

County	Percent In Study Area	Percent In Subarea	IN FARMS			NOT IN FARMS			TOTAL - OTHER LAND		
			TOTAL	Need Treatment	Treatment Adequate	TOTAL	Need Treatment	Treatment Adequate	TOTAL	Need Treatment	Treatment Adequate
Austin	99	100	23567	14500	9067	4009	2658	1351	27576	17158	10418
Brazoria	100	48	1162	482	680	2710	964	1746	3872	1446	2426
Calhoun	100	100	6472	2588	3884	24216	9686	14530	30688	12274	18414
Colorado	76	100	5067	0	5067	2217	0	2217	7284	0	7284
DeWitt	61	96	1460	286	1174	731	58	673	2191	344	1847
Fayette	20	100	1467	354	1113	349	242	107	1816	596	1220
Fort Bend	100	89	5190	1554	3636	3336	835	2501	8526	2389	6137
Goliad	80	28	2215	767	1448	511	0	511	2726	767	1959
Gonzales	1	100	159	34	125	17	0	17	176	34	142
Grimes	46	35	72	15	57	572	57	515	644	72	572
Jackson	100	100	1704	175	1529	213	15	198	1917	190	1727
Lavaca	99	100	14583	2874	11709	1620	332	1288	16203	3206	12997
Matagorda	100	100	3839	0	3839	10240	0	10240	14079	0	14079
Victoria	100	96	8335	124	8211	2727	41	2686	11062	165	10897
Waller	100	61	4188	1165	3023	878	430	448	5066	1595	3471
Washington	62	100	898	898	0	514	258	256	1412	1156	256
Wharton	100	100	15103	5001	10102	1725	700	1025	16828	5701	11127
Totals			95481	30817	64664	56585	16276	40809	152066	47093	104973

***Treatment need is shown for the dominant or limiting constraint.**

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

steads, ditch banks, fence rows, and other service areas. Other land "not in farms" includes investment and rural non-farm residence.

According to the Conservation Needs Inventory about 50 percent of the land in this category needs conservation treatment.

Land Resource Development

Land Availability and Suitability

The Middle Subarea contains 6,154,334 acres of agricultural and forest land. Eighty-five percent of this land is suitable for continuous cultivation. Another eight percent would be suitable for limited cultivation. Only inventory land (cropland, pasture-land, rangeland, forest land, and other land) is considered potentially available for agricultural use.

The acreage for each major land use by capability class is shown in Table 24 Class I land, which is suitable for continuous cultivation requiring only good cultural practices, accounts for 453,571 acres; 2,680,069 acres are Class II land, which has certain limitations such as slope or erosion susceptibility that restricts the choice of plants and requires a moderate level of conservation treatment; 2,158,650 acres are Class III soils which have severe limitations that reduce the choice of plants and require special

TABLE 24

Land Use by Capability Class, Middle Subarea

Texas Coastal Basins

Land Capability Class	Total Land Acres	Cropland Acres	Pastureland Acres	Rangeland Acres	Forest Land Acres	Other Acres	Distribution Percent
I	453571	170960	147498	88481	37067	9565	7.3
II	2680069	1225889	497981	483192	410995	62012	43.4
III	2158650	629294	395185	681678	415937	36556	34.9
Subtotal	5292290	2026143	1040664	1253351	863999	108133	85.6
IV	481448	135758	138919	137534	57923	11314	7.8
Subtotal	481448	135758	138919	137534	57923	11314	7.8
V	104570	13427	41296	13814	30543	5490	1.7
VI	260549	10744	35652	153457	34892	25804	4.6
VII	8952	835	1138	5892	1087	0	0.2
VIII	6525	0	408	4794	0	1323	0.1
Subtotal	380596	25006	78494	177957	66522	32617	6.6
TOTAL	6154334	2186907	1258077	1568842	988444	152064	100.0

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

soil, plant, and water conservation measures; 481,448 acres are Class IV soils having very severe natural limitations that restrict the choice of plants and require very special conservation practices. Class IV soils are marginal for the production of cultivated crops. There are 405,800 acres in Classes V through VIII which are not suited for cultivation because of natural limitations that restrict their use. These limitation are usually impractical or infeasible to remove in order to grow cultivated crops.

Cropland Suitable for Regular Cultivation

Presently there are 2,186,907 acres in cultivation. Slightly over 92 percent of these acres is on soils which are suited for continuous cultivation. Table 24 also reveals about 3.2 million acres of Classes I through III soils in other uses which could be cultivated with acceptable risks.

Potential for Shift from Grassland to Cropland

There are an estimated 2.2 million acres of grassland (pasture and range) which are suited for continuous cultivation. Classes I and II soils in this category account for about one million acres which can be put into cultivation by turning under the sod and applying good management practices. An additional 1.2 million acres of Class III land if put into cultivation would require

drainage systems and cropping systems to maintain the tilth and structure of the soil.

Potential for Converting Forest Land to Cropland

There are only about 37,000 acres of Class I soils in forest land. Class II soils make up 411,000 acres and primarily would require practices to prevent soil loss if they were put into cultivation. An additional 416,000 acres of Class III soils could be utilized for continuous cultivation with special practices applied to control excess water and erosion. The total forest land suited for continuous cultivation is 864,000 acres.

Potential for Shift from Cropland to Grazing Land and Forest Land

There are 25,000 acres of land in cultivated crops on soils generally not suited for cultivation. This small acreage would indicate stability in the cropland base on Classes I through IV soils. Therefore, there is little potential for a shift from cropland to grazing land and forest land.

Other Land

There are 108,000 acres of Classes I through III soils which are suitable for continuous cultivation; however, the choice of land

for this use depends primarily on location rather than soil suitability.

Conclusion

There should be sufficient supply of suitable soils in this subarea to meet the demand for additional cropland. Nearly 99 percent of the present acreage in cropland is on Types I through IV. In addition to this, over three million acres of Classes I through III agricultural and forest land could be cultivated if a need occurs. Also, another 346,000 acres of Class IV land could be formed to selected crops with specific conservation measures.

LOWER SUBAREA

Description

The Lower Subarea encompasses the area of the Texas Coastal Basins south of and including the San Antonio River Basin (Plate 8). It includes all or part of the following counties: Aransas, Bee, Brooks, DeWitt, Duval, Goliad, Jim Hogg, Jim Wells, Karnes, Kenedy, Kleberg, Live Oak, McMullen, Nueces, Refugio, San Patricio, Starr, Victoria, and Webb.

The climate is subarid with average annual precipitation ranging from 20 inches in Jim Hogg County to 36 inches in Aransas County. May and September are the months of maximum rainfall. Summers are long, hot, and relatively dry with winters being short and mild. The average growing season ranges from 319 days at Sarita in Kenedy County to 285 days at Goliad. The mean average annual temperature ranges from 70 degrees F. to 73 degrees F. throughout the area. Temperatures of above 90 degrees F. occur on an average of 90 days per year near the coast and 120 days farther inland.

Elevations vary from mean sea level to 900 feet above MSL. The Lower Subarea is generally flat and featureless for about 50 miles inland. The remainder is rolling to moderately rolling. Major stream systems are the San Antonio, Aransas, and Nueces rivers. The only large surface water impoundment is Lake Corpus Christi.

LEGEND

- (10) Interstate Highway
- [60] U S Highway
- (6) State Highway
- [555] Farm to Market Road
- Interstate Highway
- Paved Road
- City Limits
- Towns
- (C) County Seat
- County Line
- State Line
- Drainage
- Basin Boundary

Plate 8

LOWER SUBAREA

TEXAS COASTAL BASINS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

There are two general vegetational areas - South Texas Plains and Gulf Prairies and Marshes, (Plate 5). Although Bottom land occurs within these vegetational areas, it is discussed separately because of its unique characteristics.

The South Texas Plains vegetational area influences 70 percent of this subarea. It correlates very closely to the boundaries of the Rio Grande Plain Land Resource Area. Generally the present make-up of vegetative communities has been influenced by low rainfall, hot temperatures, and improper grazing management. This area originally supported a grassland or savannah type climax vegetation. Presently many trees and shrubs have invaded the area. These include mesquite, huisache, and several acacias. A more detailed discussion is included under rangeland in this section.

The Gulf Prairies is dominated by seacoast bluestem, little bluestem, Panamerican balsamscale, smutgrass, and dwarfed live oak. Cedar elm, hackberry, huisache, baccharis, and retama are principal unwanted woody species. The Gulf Marsh in this subarea is limited to a saline ribbon like strip along the coast, occasionally inundated by tidal action. Saltgrass and shoregrass grow on the tidal flats with cordgrass found around the water's edge.

Hunting opportunities abound. Deer, turkey, javelina, and quail are found in huntable populations throughout. Freshwater fishing is generally confined to Lake Corpus Christi and the Nueces River.

Padre Island National Park plus the beaches around Corpus Christi are natural attractions for natives and tourists.

The 1970 population for the Lower Subarea was almost 600,000. Nueces County, which includes the City of Corpus Christi, accounted for about 40 percent of this total.

Major contributions to the economy of this hydrologic unit are farming, ranching, tourism, mineral extraction and refining, fishing, and industrial development. Livestock and crop income for 1973 was $245.7 million. Corpus Christi has excellent port facilities for receiving raw materials and moving processed goods into world trade. Besides water transportation the area is served by an adequate network of highways and railroads.

Soils

The Gulf Coast Prairies contain about 1.5 million acres of deep dark calcareous, clayey soils. Victoria, Orelia, Clareville, and related soil series are alkine and contain a significant amount of exchangeable sodium. This area, referred to as the "Coastal Bend", is used mainly for growing cotton, grain sorghum, and vegetables.

Loamy soils cover a two-million-acre area from Beeville to near Hebbronville. The soils have varying depths of surface material

but are generally characterized by caliche at depths from 10 to 40 inches. Ridges which punctuate the rolling topography usually are characterized by caliche outcrops. Primary soil series are Delmita, Randado, Runge, Delfina, and Sarnosa.

The southmost portion of the subarea, covering about 1.5 million acres, is an area of deep sand on a hummocky landscape. Major soil series are Sarita, Falfurrias, and Nueces. Additional information on soils can be found in the report "Soils of the Texas Coastal Basins".

The distribution of land by capability class is shown in Figure 10. This classification is a practical grouping to reflect the natural limitations of the soils, the risk of damage in use, and their response to proper management. Cultivation, the most intensive use, is the baseline for comparing land capability classes. Classes I through III can generally be used for continuous cultivation with proper conservation measures to prevent deterioration of soil properties. Class IV land can be used for occasional cultivation with specific conservation measures to prevent degradation of soil properties. Soils in Classes V through VIII are generally defined as land limited in use-not generally suited for cultivation but are best suited for pasture, forest, wildlife habitat, recreation, or aesthetic purposes. Refer to pages 29 to 32 for a description of each capability class.

Land Use

The Lower Subarea contains 7,462,486 acres of land. The Conservation Needs Inventory, 1967 separates this land into inventory and non-inventory categories. Inventory land will be referred to in this report as agricultural land. This includes cropland, pastureland, rangeland, forest land, and other land. Non-inventory land includes urban built-up and federal land. The agricultural land use distribution is illustrated in Figure 11. Rangeland, which supports the south Texas ranching industry, covers most of the area. Cropland is generally confined to the "Coastal Bend".

Cropland

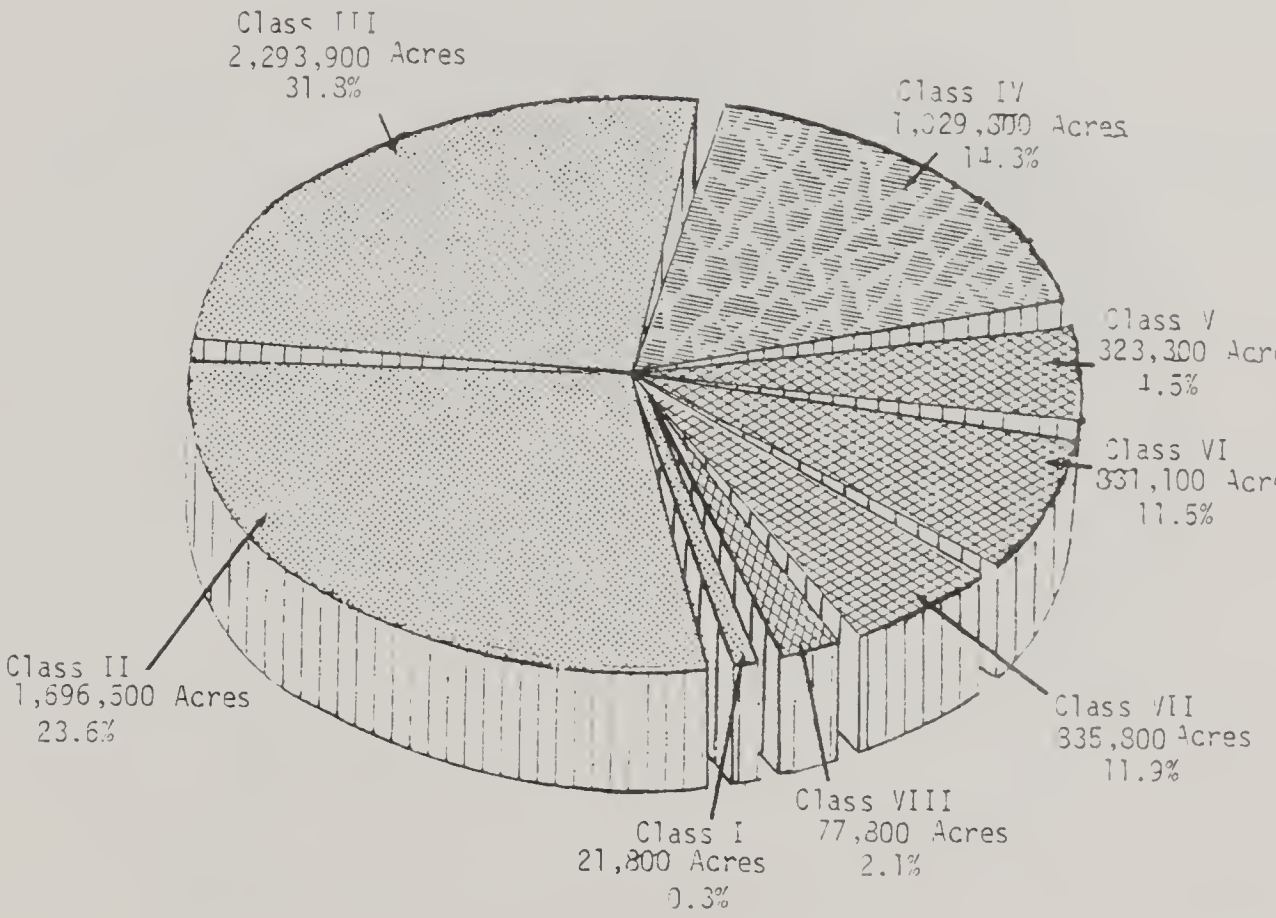
The 1967 cropland use was estimated to be 1,268,000 acres. Figure 12 shows major crops planted in 1973. Income from cultivated crops during that same year was $98.8 million. Less than one percent of the cropland was systematically irrigated. Grain sorghum accounted for 82 percent of the cropland acreage .

The Conservation Needs Inventory in 1967 expressed conservation treatment needs in terms of the problems limiting the agricultural capability of the land. Generally the degree of suitability of

FIGURE 10

Land Capability Classes for Agricultural Land, 1967

Lower Subarea, Texas Coastal Basins



SUITED FOR CONTINUOUS CULTIVATION, 4,012,200 ACRES

SUITED FOR LIMITED CULTIVATION, 1,029,800 ACRES

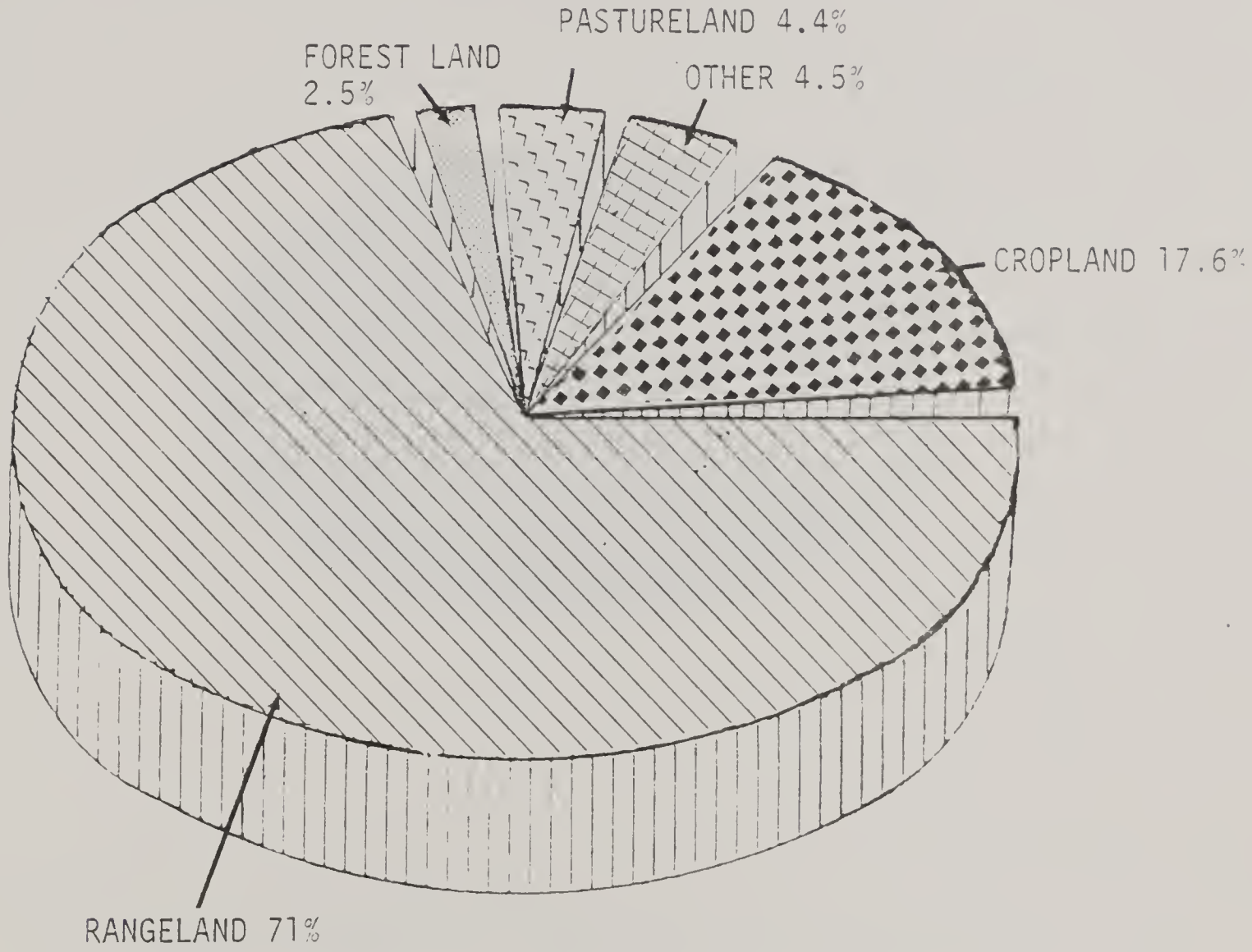
NOT SUITED FOR CULTIVATION, 2,161,400 ACRES

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

FIGURE 11

Agricultural Land Use, 1970

Lower Subarea, Texas Coastal Basins

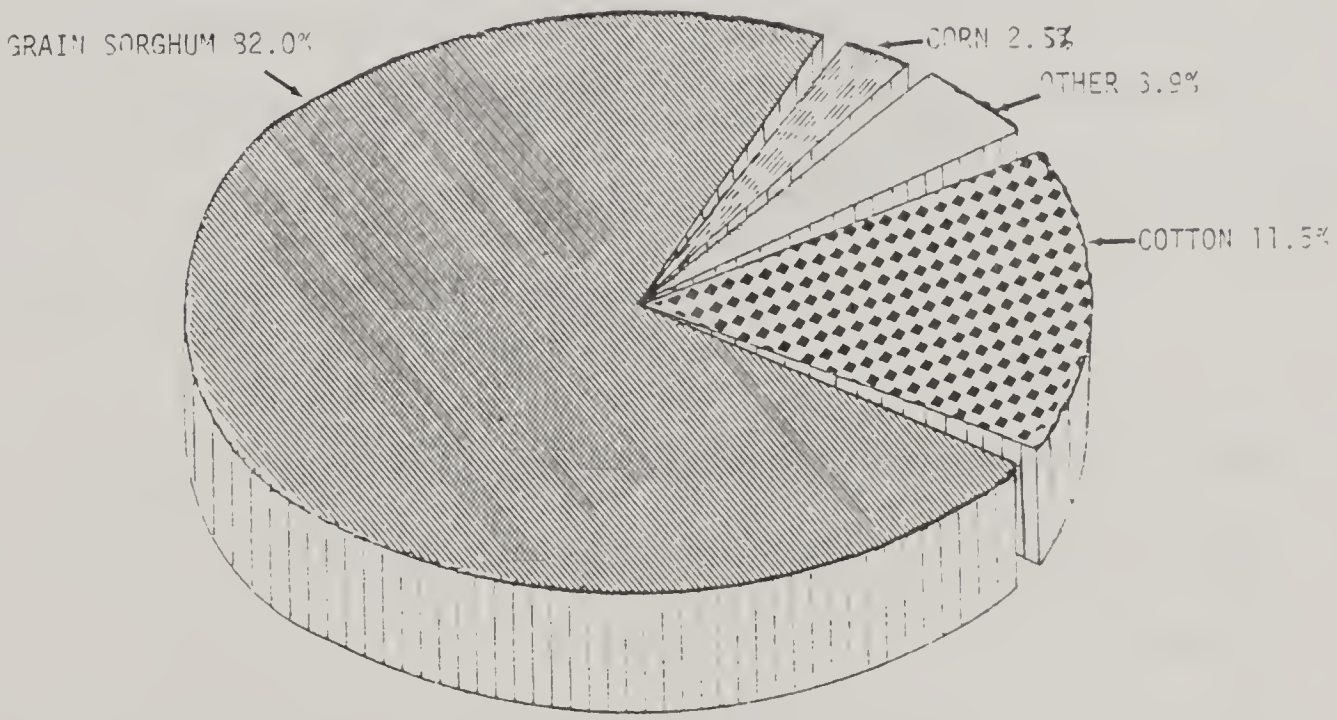


Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

FIGURE 12

Major Crops Planted, Lower Subarea 1/

Texas Coastal Basins



1/ From 1973 Texas County Statistics

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

the soils for field crops decreases as the capability class increases. Soils in the first four classes, under good management are defined as land suitable for cultivation. Classes I through III, with the use of proper conservation measures, are recommended for continuous cultivation and Class IV is suitable for only limited cultivation. Soils in Classes V through VIII are limited in use and not generally suited for cultivation. All land in Classes II through VII has a dominant problem of erosion (e), excessive wetness (w), unfavorable soil condition or extreme climatic condition (c). Various conservation treatment practices are needed to minimize the effects of these hazards.

Table 25 shows conservation treatment needs by capability class and subclass. Estimates of treatment needs were based on land capability data as well as the intensity of the crop enterprise. To avoid duplication of acreage in these estimates, the acreage of each needed practice is mutually exclusive. Even though problems occur in combinations only the most severe problem determines the treatment need. Therefore, more information should be obtained for planning on a specific area.

Thirty-eight percent of the cropland is adequately treated--that is, current conservation treatment is adequate to alleviate the limiting problem. This acreage will require continued maintenance of

TABLE 25

Conservation Treatment Needs for Cropland in the Lower Subarea, 1967*

Texas Coastal Basins

Land Capability Class and Sub-Class	Total Cropland	Adequately Treated	Needing Treatment	NON IRRIGATED CROPLAND							IRRIGATED CROPLAND			
				Residue and Annual Cover	Sod in Rotation	Contour Only	Strip Cropping Terracing Diversions	Permanent Cover	Drainage	Total	Cultural Management Practices Only	Improved Systems	Water Management	Total
I	14,654	1,737	12,917	1,339	0	0	0	104	173	1,616	2,631	3,846	4,824	11,301
IIE	142,941	52,876	90,065	17,536	0	34	64,647	6,156	11	88,384	0	1,056	625	1,681
IIIE	159,560	59,352	100,208	34,703	301	10	40,875	21,033	36	96,964	0	3,244	0	3,244
IVE	66,333	19,282	47,051	18,250	0	0	9,354	17,149	2,039	46,792	0	0	259	259
VIE	28,502	5,406	23,096	4,230	0	0	0	17,336	1,530	23,096	0	0	0	0
VIIE	6,334	37	6,297	421	0	0	249	5,627	0	6,297	0	0	0	0
IIW	49,683	26,312	23,371	5,291	0	0	0	19	18,061	23,271	0	0	0	0
IIIW	59,856	12,515	47,341	30,202	0	11	0	498	16,607	47,318	0	23	0	23
IVW	3,424	0	3,424	3,424	0	0	0	0	0	3,424	0	0	0	0
VW	23,440	777	22,663	15,560	0	0	1,947	2,801	1,867	22,175	0	488	0	488
IIS	280,830	159,941	120,889	91,627	11	745	1,586	1,817	19,957	115,743	597	2,650	1,899	5,146
IIIS	180,008	35,564	144,444	110,676	249	0	6,274	857	24,452	142,508	0	1,936	0	1,936
VS	2,570	0	2,570	2,570	0	0	0	0	0	2,570	0	0	0	0
VIS	1,834	0	1,834	0	0	0	0	1,834	0	1,834	0	0	0	0
VIIS	15,896	7,459	8,437	19	0	0	1,649	6,769	0	8,437	0	0	0	0
IIC	188,874	87,687	101,187	91,423	0	0	5,439	1,501	2,824	101,187	0	0	0	0
IIIC	35,965	17,578	18,387	13,777	0	0	0	3,080	1,530	18,387	0	0	0	0
IVC	7,585	3,469	4,116	4,116	0	0	0	0	0	4,116	0	0	0	0
TOTALS	1,268,289	489,992	778,297	445,164	561	800	132,020	86,587	89,087	754,219	3,228	13,243	7,607	24,078

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

established practices. The need for returning residue and establishing an annual cover is most pressing while strip cropping, terraces, diversions, permanent cover, and drainage are needed on significant acreages. These practices may be needed in various combinations to form conservation treatment systems to adequately meet the needs of the resources.

Pastureland

There are 315,997 acres of pastureland in the Lower Subarea. These pastures contain introduced plants which are adapted to the local environment and managed primarily for forage production. These plants, when managed properly, provide adequate protection for the soil.

This pastureland occurs in two major vegetational areas of Texas as described by Gould. They are the South Texas Plains and Gulf Prairies.

South Texas Plains Vegetational Area

There are approximately 238,000 acres of pastureland generally found on Goliad, Runge, Miguel, Leming, and Sarnosa soil series. Coastal bermudagrass is the most popular pasture grass. It is

probably planted 85 percent of the time. Other introduced grasses include kleingrass, gordo bluestem, King Ranch bluestem, medio bluestem, and Angleton bluestem. Production varies greatly depending upon available moisture growing conditions, and grazing management techniques but on the average four to seven acres of coastal bermudagrass will provide grazing for an annual animal unit.

Gulf Prairies Vegetational Area

The remaining approximately 100,000 acres in pastureland is generally found on the Victoria and Raymondville soil series. Generally these soils are used for cultivated crops, with some scattered areas of pastureland. Coastal bermudagrass is usually sprigged in the loamy soils while improved bluestems are planted where the soils have a high clay content. Production potential is an annual animal unit of grazing from three to four acres. Basically problems are caused by adverse climatic factors. Conversion of cropland to pastureland has resulted from owner preference primarly and is not widespread.

Problems and Needs

The major problems deal with management. Low, erratic rainfall magnifies these problems. Drought and improper grazing management encourages invasion by weeds and brush. Despite these problems the trend is to establish more pasture grasses. This is especially true after brush has been controlled mechanically. Some coastal

bermuda pastures are receiving supplemental irrigation where water is available.

The conservation treatment for pastureland in 1970 are shown by capability class and subclass in Table 26. This conservation treatment involves both the protection of the soil and proper utilization of the plant resource for sustained forage production. Of the 137,000 acres which need treatment, 100,000 acres need only protection and improvement. This usually involves the application of sound grazing management techniques so that the present plant community can increase its density and vigor. Re-establishment is needed on about 37,000 acres.

Rangeland

This land use accounts for 68.5 percent of the land in the Lower Subarea. There are 5.1 million acres of native grasses and forbs used primarily for producing livestock. This rangeland occurs in two vegetational areas, as described by Gould - South Texas Plains and Gulf Prairies and Marshes. The rangeland along or in the bottom land is discussed separately for this report.

South Texas Plains Vegetational Area

Gould (1) describes the South Texas Plains as originally supporting a grassland or savannah type of climax vegetation. The most

TABLE 26

Conservation Treatment Needs for Pastureland in the Lower Subarea, 1967*

Texas Coastal Basins

Land Capability Class and Sub Class	Total	Treatment Adequate	Treatment Infeasible	Change in Land Use	Total Needing Treatment	TREATMENT NEEDS						
						IMPROVE VEGETATIVE COVER				REESTABLISH VEGETATIVE COVER		
						Protection Only	Improvement Only	Brush Control and Improvement	Total	Reestablish-ment Only	Brush Control and Reestablishment	Total
I	4,982	1,632	0	0	3,350	343	509	80	932	28	2,390	2,418
IIE-IVE	143,014	78,484	791	0	63,739	18,314	29,841	5,635	53,790	5,079	4,870	9,949
IIW-IVW	16,810	10,160	0	0	6,650	4,621	398	412	5,431	0	1,219	1,219
IIS-IVS	58,254	24,181	408	0	33,665	15,119	6,469	587	22,175	8,742	2,748	11,490
IIC-IVC	59,213	40,277	27	0	18,909	692	7,001	1,328	8,931	0	9,978	9,978
VE-VIIIE	2,678	658	0	0	2,020	795	795	0	1,590	27	403	430
VW-VIIIW	11,297	4,809	199	0	6,289	2,449	2,874	496	5,819	67	403	470
VS-VIIIS	19,749	17,307	0	0	2,442	239	128	1,285	1,652	686	104	790
TOTAL	315,997	177,508	1,425	0	137,064	42,482	48,015	9,823	100,320	14,629	22,115	36,744

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

prevalent grasses are trichloris, pink pappusgrass, seacoast bluestem, bristlegrasses, and silver bluestem. Heavy continuous grazing, drought, and other factors have resulted in brush species such as mesquite, blackbrush, whitebush and acacia species and other woody species dominating in the plant community. The South Texas Plains vegetational area is subdivided into five vegetative groups based primarily on homogeneity in the surface layer of the soils (plate 6).

Calcareous Sandy Loam Vegetative Group. This vegetative groups makes up about 469,000 acres primarily on Sarnosa and Runge soil series. The original plant community is an open grassland with a few scattered woody plants throughout the landscape. Grasses such as plains bristlegrass, windmillgrass, pink pappusgrass, and lovegrass tridens account for about 90 percent of the original vegetation. Perennial forbs such as snoutbeans and orange zexmenia make up five percent, with woody plants such as blackbrush acacia, spiny hackberry, guayacan, and other low growing shrubs accounting for the remaining five percent.

Improper grazing and adverse climatic factors have altered the original plant community. Presently most of the area has less than 40 percent of the original climax vegetation remaining. Sparse

stands of climax plants characterize the landscape. The brushy species have increased or invaded to form as much as a 60 percent canopy in many areas. The brush complex is made up of blackbrush acacia, spiny hackberry, condalias, and lime pricklyash. Ceniza, a small woody plant, is generally abundant because of its affinity for the calcareous soil.

Following mechanical brush management or manipulation of the woody plant community buffelgrass is frequently established for erosion control as well as increased production. This plant produces high amounts of good forage and is managed like a native plant.

Shallow Sandy Loam Vegetative Group. This vegetative group includes 1,475,700 acres primarily on Delmita, Olmos, and Randado soil series. The original plant community is an open grassland with scattered low stunted shrubs and many forbs. Annual plants are common in the original vegetation because the shallow soil limits the longevity of perennial plants. Arizona cottontop, trichloris, pinhole bluestem, silver bluestem, slim tridens, hooded windmillgrass, and bristlegrass account for about 85 percent of the vegetation. Ten percent of the original plant community is composed of forbs such as bushsunflower, orange zexmenia, catclaw sensitivebriar, and snoutbeans. Many species of brush such as condalia, guayacan, sumac, and blackbrush acacia make up the remaining five percent.

The present plant community has retrogressed significantly as compared to the original plant community. Less than 35 percent of the original vegetation remains in the present plant community. Red grama, red lovegrass, hooded windmillgrass, threeawn, and tumblegrass can be found throughout the area. Brush species are quick to fill the voids created by the disappearance of grasses and forbs as has resulted from mismanagement of grazing resources. This vegetative group is characterized by canopies of blackbrush acacia, guajillo, leatherstem, and others in excess of 60 percent.

Buffelgrass is being planted frequently following root plowing. However, kleingrass is gaining acceptance by landusers due to its high quality forage and widespread adaptability.

Deep Sandy Vegetative Group. This vegetative group consists of approximately 1,593,500 acres. The major soil series are Sarita and Falfurrias. The original plant community is characterized by open grassland with a few mesquite trees dotting the landscape. Some large live oak trees or motts of live oak trees are found on the deeper sands. The composition of the original plant community is 90 percent grasses, five percent forbs, and five percent woody plants. Seacoast bluestem is the dominant grass; forbs include snoutbeans, sensitivebriar, gayfeather, partridgepea, and beebalm while live oak and mesquite are the most common woody species.

The present plant community contains less than 50 percent of the original vegetation due to a history of improper livestock grazing and drought. Only remnant colonies of seacoast bluestem remain while balsamscale, red lovegrass, threeawn, and beebalm have either increased or invaded to dominate the plant community. Generally the woody plant canopy which is made up of live oak and mesquite trees does not exceed 20 percent.

The deep sandy soil and the very limited rainfall provides a poor environment for seedling growth. Seed sources of native grasses are not available commercially and introduced grasses do not adapt to the environment. Some areas have been seeded to buffelgrass while others have tried coastal bermudagrass both with limited success.

Sandy Loam Vegetative Group. This vegetative group covers about 436,400 acres (Plate 6). Major soil series involved are Willacy, Delfina, and Orelia. The original plant community is an open grassland with occasional mesquite trees. Dominant grasses in the original plant community are trichloris, Arizona cottontop, pappusgrass, and silver bluestem. Perennial forbs include bushsunflower, orange zexmenia, and sensitivebriar. Mesquite, spiny hackberry, and condalias are the most common woody plants. This group in its original state produces 2,000 to 4,500 pounds of air dry forage per acre.

The present plant community contains less than 40 percent of the original plant species. Due to misuse of grazing lands coupled with drought thick stands of brush have created a canopy in excess of 50 percent in most areas. Mesquite, whitebrush, spiny hackberry, condalia, and blackbrush acacia have formed dense colonies. Sparse stands of red grama, threeawn, halls panicum, bristlegrass, and hooded windmillgrass currently characterize much of the herbaceous plant community. Generally this vegetative group is producing less than 2,500 pounds of air dry forage per acre per year.

Root plowing has proven to be an effective method of brush control. After root plowing seeding to various introduced bluestem are normally carried out by many landowners.

Tight Sandy Loam Vegetative Group. This vegetative group covers about 459,000 acres and is generally a transition area between the Gulf Prairies, Post Oak Savannah, and South Texas Plains vegetational areas. The major soil series are Orelia, Miguel, and Leming. The original plant community is an open grassland with the landscape sprinkled with occasional live oak and mesquite trees. The original plant composition was 90 percent grasses, five percent forbs, and five percent woody plants. The dominant grasses are trichloris; forbs are bundleflower, snoutbean, and sensitivebriar; and the principal woody plants are live oak and mesquite. The original plant community produces an average of about 3,500 pounds of air dry forage per acre per year.

This vegetative group generally has less than 40 percent of the original vegetation remaining. Improper grazing management and drought have resulted in secondary plant species such as buffalograss, bristlegrass, and hooded windmillgrass increasing while trichloris has decreased. Red grama, hooded dropseed, and threeawn also have increased in density. Huisache, mesquite, spiny hackberry, and condalia have invaded or increased to form nearly a 50 percent canopy. In this condition the group is producing about 2,500 pounds of air dry forage per acre per year.

Gulf Prairies Vegetational Area

The original plant community is a true prairie. The rangeland in this vegetational area was subdivided into a deep sandy vegetative group, sandy loam vegetative group, tight sandy loam vegetative group, clay and clay loam vegetative group, and a coastal sandy vegetative group.

Deep Sandy Vegetative Group. There are almost 200,000 acres in this group on primarily the Sarita, Falfurrias, and Nueces soil series. The original plant community is tall grasses and scattered live oak motts. The original plant community consist of 90 percent grasses, five percent forbs, and five percent woody species. Seacoast bluestem is the most prevelant grass, snoutbeans the most common forb, and live oak is the most dominant woody plant. The

original plant community produces approximately 4,500 pounds of air dry forage per acre per year.

The present plant community is still dominated by seacoast bluestem but brownseed paspalum, Gulf muhly, and threeawn have increased significantly. Grazing pressure and prolonged dry periods make plant composition a highly variable situation. Dwarf live oak have increased to sizeable colonies in some areas. In its present condition this vegetative group produces less than 2,500 pounds of air dry forage per acre per year.

Sandy Loam Vegetative Group. This group is located on Orelia and Leming soils in a transition area between the Gulf Prairies and South Texas Plains. It covers about 78,000 acres of land that are a true prairie. Little bluestem dominate the plant community and is complemented by Indiangrass, crinkleawn, and big bluestem. Dominant forbs in the climax plant community are gayfeather, sensitivebriar, bundleflower, and yellow neptunia. Woody plants are generally not found in the original vegetation; however, local areas where the soil is more acid post oak is growing. The original plant community will produce 8,500 pounds of air dry forage per acre per year.

This vegetative group now contains about half of the original vegetation. Improper grazing management, absence of fire, and prolonged dry periods have resulted in the bluestems decreasing in

density and brownseed paspalum, Panamerican balsamscale, knotroot bristlegrass, and smutgrass increasing. Woody plants such as huisache, sesbania, and macartney rose are also encroaching in competitive amounts. The present plant community generally produces less than 3,500 pounds of air dry forage per acre per year.

The trend has been to convert poor and fair condition rangeland in this group to coastal bermudagrass and other improved pasture grasses.

Tight Sandy Loam Vegetative Group. This vegetative group covers about 200,000 acres and is generally a transition area between the Gulf Prairies, Post Oak Savannah, and South Texas Plains vegetational areas. The major soil series are Orelia, Miguel, and Leming. The original plant community is an open grassland with the landscape sprinkled with occasional live oak and mesquite trees. The climax plant community consist of 90 percent grasses, five percent forbs, and five percent woody plants. The dominant grasses are trichloris; forbs include bundleflower, snoutbean, and sensitivebriar; dominant and woody plants are live oak and mesquite. The original plant community produces an average of about 3,500 pounds of air dry forage per acre per year.

This vegetative group has less than 40 percent of the original vegetation remaining. Misuse of grazing lands and drought have resulted in buffalograss, bristlegrass, and hooded windmillgrass

increasing while trichloris has decreased. Red grama, hooded dropseed, and threeawn also have increased in density. Huisache, mesquite, spiny hackberry, and condalia have invaded or increased to form nearly a 50 percent canopy. In this condition the group is producing about 3,000 pounds of air dry forage per acre per year.

Clay and Clay Loam Vegetative Group. This group is found on fertile coastal plain soils, predominantly Victoria and Raymondville soil series. It covers approximately 334,000 acres. The original vegetative community is a true prairie with grasses making up 95 percent of the vegetation and forbs accounting for the remaining five percent. Little bluestem is the dominant grass with Indiangrass a strong subdominant. Other significant grasses are switchgrass, eastern gamagrass, big bluestem, brownseed paspalum, Texas wintergrass, and meadow dropseed. Common forbs are sensitivebriar, yellow neptunia, and bundleflower. The original plant community produces 9,500 pounds of air dry forage per acre per year.

The present plant community still contains about 75 percent of the species found in the original plant community; however, the loss of the tall grass species represents a significant loss of forage production. The bluestems and Indiangrass have decreased while Texas wintergrass, brownseed paspalum, and meadow dropseed increase. Huisache, baccharis, macartney rose, and sesbania have increased to levels where they are highly competitive for mositure and

nutrients. On an average this vegetative group will produce about 3,000 pounds of air dry forage per acre per year.

The soils of this vegetative group are inherently fertile and are much in demand for cultivation. The rangeland generally is in larger ownerships whose previous management goals have not included cultivation. If ownership changes occur with different management objectives these soils are well suited for cultivation; therefore, the conversion from rangeland to cropland could accelerate.

Coastal Sandy Vegetative Group. The coastal sandy vegetative group (Plate 6) occurs on nearly level to undulating or duned coastal terraces which may be interspersed with depressions. Principal soil series are Galveston and Mustang. The climax plant community of this group is varied depending upon topography and elevation. The sandy ridges and mounds are dominated by seacoast and little bluestem. Subdominants are switchgrass and gulfdune paspalum. Switchgrass is the dominant plant in the swales. Longtom and marshhay cordgrass also grow in the depressions. Principal forbs are sensitivebriar and bundleflower.

The present plant community is composed of gulfdune paspalum, low panicum, marshhay cordgrass, switchgrass, longtom, and little bluestem. On Matagorda Island gulfdune paspalum and seaoats are most prevalent. Generally in its present condition the deep sandy

vegetative group will produce from 2,000 to 3,000 pounds of air dry vegetation per acre annually.

Bottom Land

The area within the Bottom land consists of approximately 200,000 acres. The major soil series found are Aransas and Sinton. The original vegetation is a savannah of oak, elm, hackberry, cottonwood, anaqua, pecan, and other large trees. These trees provide about a 25 percent canopy. This overstory usually becomes more dense adjacent to the stream. Underbrush include berryvines, greenbriar, and grapes. Grasses comprise 85 percent of the total composition of the plant community in the original state. Twenty-five percent of the vegetation is made up of grasses such as southwestern bristlegrass, Virginia wildrye, and rustyseed paspalum. Other grasses found in lesser amounts are switchgrass, little bluestem, trichloris, knotroot bristlegrass, white tridens, low panicums, and vine mesquite. These contribute about five percent each to the total plant community. Woody plants account for 10 percent of the total vegetation with oaks, elms, and pecans dominant. Forbs such as snoutbean, engelmanndaisy, and sensitivebriar make up five percent of the original community. The original plant community produces approximately 8,000 pounds per acre of air dry forage per year.

Past heavy use, coupled with drought, has altered the original plant community. Most of the area now has less than 30 percent

of the species found in the original plant community. The present vegetation consists of dense canopies of trees and shrubs. Only shade tolerant grasses remain in this understory. In open areas, bermudagrass and buffalograss increase at the expense of tall grasses. In this condition, this group generally produces less than 3,000 pounds per acre of air dry vegetation and requires more than 15 acres to safely carry one animal unit yearlong.

In many cases the brush canopy is being opened by mechanical means and common bermudagrass is being managed as pastureland. On areas not subject to frequent overflow, cropland competes with rangeland.

Problems and Needs

Many problems exist which are common to all vegetative groups and vegetational areas in the Lower Subarea. Improper grazing management is the primary problem. It is one of the major factors responsible for altering the composition of the original plant community to its present condition well below the productive level of the climax state. Brush is another major problem. Probably 80 percent of the rangeland in the South Texas Plains Vegetational Area (3.0 million acres) is in need of some degree of brush control. Livestock water is unavailable in some areas and limited in others. Distribution of water sources and location of cross fences are key

factors in obtaining uniform grazing in large operating units. There are other problems peculiar to certain vegetative groups such as control of pricklypear and the lack of commercially available seed for grasses that are adaptable on the Deep Sandy Vegetative Group.

The conservation treatment needs for rangeland by land capability class and subclass are shown in Table 27. It is interesting to note that erosion is the paramount conservation hazard on almost three million acres. Seventy-five percent of the rangeland needs conservation treatment to protect or enhance the plants and soils. Treatment needs are divided into two categories - improvement of the vegetative cover and reestablishment of the vegetative cover.

Improvement is usually associated with management practices. Rangeland needing protection is in a mismanaged state, that is, the desirable vegetation is present but has been significantly affected by improper grazing techniques. Planned grazing systems, proper grazing use and deferred grazing is often used to accomplish this objective. If rangeland is in very poor condition it may be necessary to reestablish these grasslands to secure an adequate stand quickly. The column is labeled Improvement Only, Table 27. Brush control and improvement are needed where encroachment of woody and noxious plants threaten the grass cover and forage production potentials. Chemical or mechanical measures may be necessary to manipulate the woody plants.

TABLE 27

Conservation Treatment Needs for Rangeland in the Lower Subareas, 1967*

Texas Coastal Basins

Land Capability Class and Sub Class	Total	Treatment Adequate	Treatment Infeasible	Change in Land Use	Total Needing Treatment	TREATMENT NEEDS						
						IMPROVE VEGETATIVE COVER				REESTABLISH VEGETATIVE COVER		
						Protection Only	Improvement Only	Brush Control and Improvement	Total	Reestablish-ment Only	Brush Control and Reestablishment	Total
I	1,891	1,002	0	0	889	0	0	889	889	0	0	0
IIE-IVE	1,976,999	416,125	2,272	0	1,558,602	72,395	101,841	151,057	325,293	44,983	1,188,326	1,233,309
IIW-IVW	115,860	6,621	89	0	109,150	5,471	7,251	27,002	39,724	7,406	62,020	69,426
IIS-IVS	749,638	137,440	538	0	611,660	68,264	37,103	163,474	268,841	19,965	322,854	342,819
IIC-IVC	481,022	49,067	1,473	0	430,482	39,560	7,046	10,028	56,634	20,579	353,269	373,848
VE-VIIIE	1,002,473	453,096	6,650	0	542,727	53,437	34,394	11,706	99,537	9,031	434,159	443,190
VW-VIIIW	315,719	106,697	5,415	0	203,607	25,207	29,870	29,618	84,695	9,939	108,973	118,912
VS-VIIIS	467,555	75,782	11,561	0	380,212	48,476	7,932	17,097	73,505	28,926	277,781	306,707
TOTAL	5,111,157	1,245,830	27,998	0	3,837,329	312,810	225,437	410,871	949,118	140,829	2,747,382	2,888,211

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

The other category is Reestablishment of Vegetative Cover. It may be necessary to provide only a seed source for the desired vegetation or brush management may be necessary before seeding could be successful. There are approximately 2.8 million acres in this category in the Lower Subarea.

Forest Land

The Conservation Needs Inventory 1970 classified 180,000 acres of land as non-commercial forest land (Table 28). The majority of this area is a post oak-blackjack oak complex which is managed primarily for livestock production and wildlife habitat. Timbered bottom land accounts for the remainder of the acreage. The forest land is adequately treated.

Other Land

All agricultural land not classified as cropland, pastureland, rangeland, or forest land is placed in this category. Approximately 234,200 acres or 4.5 percent of the agricultural land in the sub-area falls into this classification (Table 29). The Conservation Needs Inventory 1970 shows land in farms and land not in farms. Examples of the "in farms" category would be feed lots, farm roads, farmsteads, ditch banks, fence rows, and other service areas. Other land "not in farms" includes investment tracts and rural

TABLE 28

Conservation Treatment Needs for Forest Land in the Lower Subarea, 1967*

Texas Coastal Basins

County	COMMERCIAL FOREST				NON-COMMERCIAL FOREST			TOTAL FOREST			
	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Timber Stand Improve-ment	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Total	Treatment Adequate	Establish-ment and Reinforce-ment	Timber Stand Improve-ment
Aransas	0	0	0	0	10,570	10,570	0	10,570	10,570	0	0
Bee	0	0	0	0	5,585	5,585	0	5,585	5,585	0	0
Brooks	0	0	0	0	0	0	0	0	0	0	0
DeWitt**	0	0	0	0	2,750	2,750	0	2,750	2,750	0	0
Duval**	0	0	0	0	0	0	0	0	0	0	0
Goliad**	0	0	0	0	123,929	123,929	0	123,929	123,929	0	0
Jim Hogg**	0	0	0	0	0	0	0	0	0	0	0
Jim Wells	0	0	0	0	0	0	0	0	0	0	0
Karnes**	0	0	0	0	32	32	0	32	32	0	0
Kenedy	0	0	0	0	0	0	0	0	0	0	0
Kleberg	0	0	0	0	0	0	0	0	0	0	0
Live Oak**	0	0	0	0	6,625	6,625	0	6,625	6,625	0	0
McMullen**	0	0	0	0	0	0	0	0	0	0	0
Nueces	0	0	0	0	0	0	0	0	0	0	0
Refugio	0	0	0	0	21,591	21,591	0	21,591	21,591	0	0
San Patricio	0	0	0	0	8,769	8,769	0	8,769	8,769	0	0
Starr**	0	0	0	0	0	0	0	0	0	0	0
Victoria**	0	0	0	0	263	263	0	263	263	0	0
Webb**	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	0	0	0	180,114	180,114	0	180,114	180,114	0	0

*Treatment need is shown for the dominant or limiting constraint.
**Denotes partial county in subarea

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

TABLE 29

Conservation Treatment Needs for Other Land in the Lower Subarea, 1967*

Texas Coastal Basins

County	Percent In Study Area	Percent In Subarea	IN FARMS			NOT IN FARMS			TOTAL - OTHER LAND		
			TOTAL	Need Treatment	Treatment Adequate	TOTAL	Need Treatment	Treatment Adequate	TOTAL	Need Treatment	Treatment Adequate
Aransas	100	100	196	0	196	31100	0	31100	31296	0	31296
Bee	100	100	4340	2112	2228	1738	1114	624	6078	3226	2852
Brooks	100	100	1632	940	692	1632	210	1422	3264	1150	2114
DeWitt	61	4	62	12	50	31	2	29	93	14	79
Duval	82	100	5482	1382	4100	2055	1235	820	7537	2617	4920
Gotiad	80	72	6216	2153	4063	1434	0	1434	7650	2153	5497
Jim Hogg	75	100	333	134	199	108	56	52	441	190	251
Jim Wells	100	100	2016	0	2016	0	0	0	2016	0	2016
Karnes	7	100	677	530	147	73	73	0	750	603	147
Kennedy	100	100	3310	0	3310	65135	0	65135	68445	0	68445
Kleberg	100	100	1594	0	1594	9283	0	9283	10877	0	10877
Live Oak	71	100	9168	5396	3772	142	71	71	9310	5467	3843
McMullen	3	100	37	19	18	0	0	0	37	19	18
Nueces	100	100	10654	0	10654	30824	13000	17824	41478	13000	28478
Refugio	100	100	9135	300	8835	2610	150	2460	11745	450	11295
San Patricio	100	100	16499	0	16499	14312	0	14312	30811	0	30311
Starr	24	100	287	239	48	192	168	24	479	407	72
Victoria	100	4	347	5	342	113	2	111	460	7	453
Webb	7	100	819	483	336	614	246	368	1433	729	704
Totals			72804	13705	59099	161396	16327	145069	234200	30032	204168

*Treatment need is shown for the dominant or limiting constraint.

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

non-farm residences. Ninety percent of the other land is adequately protected by conservation measures.

Land Resource Development

Land Availability and Suitability

The Lower Subarea contains 7,109,759 acres of agricultural and forest land (Table 30). Almost 56 percent is suitable for continuous cultivation. An additional 14 percent is suitable for limited cultivation under prescribed management. The remaining 30 percent is unsuitable for cultivation. Only inventory acreage (cropland, pastureland, rangeland, forest land, and other land) is considered potentially available for agricultural use.

Class I land, which is suitable for continuous cultivation requiring only good cultural practices, accounts for 21,760 acres; 1,696,455 acres are Class II land which have certain limitations such as slope or erosion susceptibility that restrict the choice of plants and require a moderate level of conservation treatment; Class III land includes 2,293,867 acres which have severe limitations that restrict the choice of plants and require special natural resource conservation measures; 1,029,771 acres are Class IV land which have very severe natural limitations that restrict the choice of plants and require very special conservation treatment measures. Class IV

TABLE 30

Land Use by Capability Class, Lower Subarea

Texas Coastal Basins

Land Capability Class	Total Inventory Land Acres	Cropland Acres	Pastureland Acres	Rangeland Acres	Forest Land Acres	Other Acres	Distribution Percent
I	21760	14654	4982	1891	36	197	0.3
II	1696455	662328	110584	817918	73703	31922	23.6
III	2293867	435389	134514	1626530	64463	32971	31.8
Subtotal	4012082	1112371	250080	2446339	138202	65090	55.7
IV	1029771	77342	32193	879071	19993	21172	14.3
Subtotal	1029771	77342	32193	879071	19993	21172	14.3
V	323262	26010	16080	257505	12427	11240	4.5
VI	831069	30336	2664	768764	8231	21074	11.5
VII	835787	22230	14980	745014	1261	52302	11.9
VIII	77788	0	0	14464	0	63324	2.1
Subtotal	2067906	78576	33724	1785747	21919	147940	30.0
TOTAL	7109759	1268289	315997	5111157	180114	234202	100.0

Source: United States Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Texas, 1970

land is marginal for the production for cultivated crops. There are 2,067,906 acres in Classes V through VIII which are not suited for cultivation because of natural limitations which restrict their use. These limitations are usually impractical or infeasible to remove in order to produce cultivated crops without usually high risk.

Cropland Suitable for Regular Cultivation

In 1970 1,268,289 acres were in cultivation. Eighty percent of these acres is on soils which are suited for continuous cultivation. Table 30 also reveals about 2.8 million acres of Classes I through III soils in other uses which could be cultivated with acceptable risks.

Potential for Shift from Grassland to Cropland

There are about 2.7 million acres of grassland (pasture and range) which are suited for continuous cultivation. Classes I and II soils contain almost one million acres which can be put into cultivation by turning under the sod and applying good management practices. An additional 1.7 million acres of Class III land could be converted to cropland by applying practices to protect the soil from erosion.

Potential for Converting Forest Land to Cropland

There are only 180,000 acres of forest land in this subarea. About 138,000 acres are in Classes I through III, which are located generally

adjacent to watercourses. The configuration of these areas would not lend themselves to cultivation. Assuming the entire acreage could be put into cropland, the overall impact on land use would be insignificant.

Potential for Shift from Cropland to Grazing Land and Forest Land

There are about 78,000 acres of cropland on soils generally not suited for cultivation. This small acreage would indicate the cropland base has stabilized on Classes I through IV soils. Therefore, there is little potential for converting cropland to grazing land and forest land.

Other Land

There are 65,000 acres of land suitable for continuous cultivation; however, the choice of land for this use depends primarily on location rather than soil suitability.

Conclusion

A sufficient amount of suitable acres in this subarea exist to meet the demand for cropland in the future. Approximately 94 percent of the acres presently being farmed is on Classes I through IV land. Also another 4.8 million acres of Classes I through IV agricultural and forest land could be put in cultivation if the need arises.

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